SOIL SURVEY

Iowa County, Iowa

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
In cooperation with
Iowa Agricultural Experiment Station

Issued May 1967

Major fieldwork for this soil survey was done in the period 1956–60. Soil names and descriptions were approved in 1965. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1965. This survey was made cooperatively by the Soil Conservation Service and the Iowa State University Agricultural Experiment Station; it is part of the technical assistance furnished to the Iowa County Soil Conservation District.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY of Iowa County ... veloped by using the soil map and infor-

Contents

	Page	Descriptions of the soils—Continued	Page
How this survey was made	1	Tama series	41
General soil map	2	Tell series	42
1. Otley-Ladoga-Clinton association	2	Udolpho series	43
2. Ladoga-Otley-Adair-Shelby association	3	Wabash series	43

EXPLANATION

Series Year and Series Number

Series year and number were dropped from all soil surveys sent to the printer after December 31, 1965. Many surveys, however, were then at such advanced stage of printing that it was not feasible to remove series year and number. Consequently, the last issues bearing series year and number will be as follows:

- Series 1957, No. 23, Las Vegas and Eldorado Valleys Area, Nev.
- Series 1958, No. 34, Grand Traverse County, Mich.
- Series 1959, No. 42, Judith Basin Area, Mont.
- Series 1960, No. 31, Elbert County, Colo. (Eastern Part)
- Series 1961, No. 42, Camden County, N.J.
- Series 1962, No. 13, Chicot County, Ark.
- Series 1963, No. 1, Tippah County, Miss.

Series numbers will be consecutive in each series year, up to and including the numbers shown in the foregoing list. The soil survey for Tippah County, Miss., will be the last to have a series year and series number.

SOIL SURVEY OF IOWA COUNTY, IOWA

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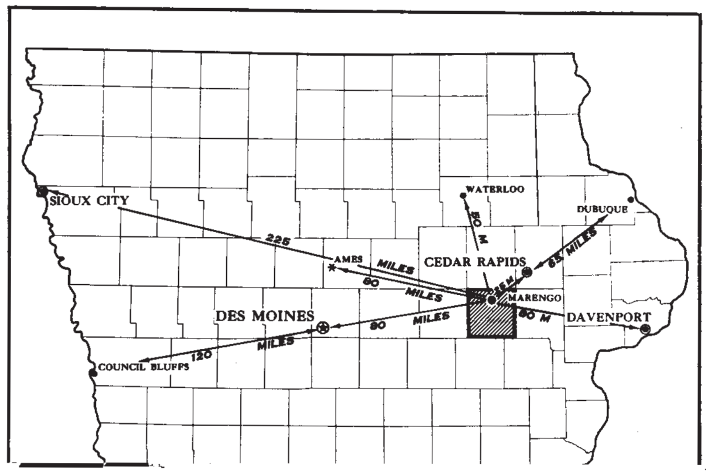
UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, IN COOPERATION WITH THE IOWA AGRICULTURAL EXPERIMENT STATION

IOWA COUNTY is in the east-central part of Iowa (fig. 1). It has a total area of 584 square miles, or 373,760 acres. Marengo, the county seat, is about 30 miles west of Iowa City.

The county is primarily agricultural. Although vegetables are grown on nearly every farm for home use, the principal crops are corn, oats, soybeans, and hay. Most of the grain that is grown is fed to livestock. Beef cattle and hogs are the principal source of income, but dairy farming is also important.



How This Survey Was Made

Soil scientists made this survey to learn what kinds of soils are in Iowa County, where they are located, and how they can be used.

They went into the county knowing they likely would and other details that greatly help in drawing boundaries accurately. The soil map in the back of this report was prepared from the aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning

compare different parts of a county, or who want to know the location of large tracts that are suitable for a certain kind of farming or other land use. Such a map is not suitable for planning the management of a farm or field, because the soils in any one association ordinarily differ

[redacted]

glacial till, but in some places this line is blurred by the sloughing of the loess.

The Ely, Judson, Colo, and Nodaway soils occur to a minor extent in the association. The Ely and Judson soils are in drainageways near the steeper soils of the uplands. The Colo and Nodaway soils are near the center of drainageways.

The soils of this association vary in color and in thickness of the surface layer. They commonly are medium or low in organic-matter content. Their available moisture capacity is adequate for most crops during years of normal rainfall. Drainage is good in most places, but livestock for market. Some cattle are raised, but many are brought in from outside the county.

Although most farm buildings are now occupied, buildings in the steeper areas are being abandoned as farms

The Nodaway soils are moderately well drained or somewhat poorly drained. They commonly occur nearer to stream channels than the Colo, Wabash, and Zook soils and thus are frequently overflowed. The Nevin and Wiota

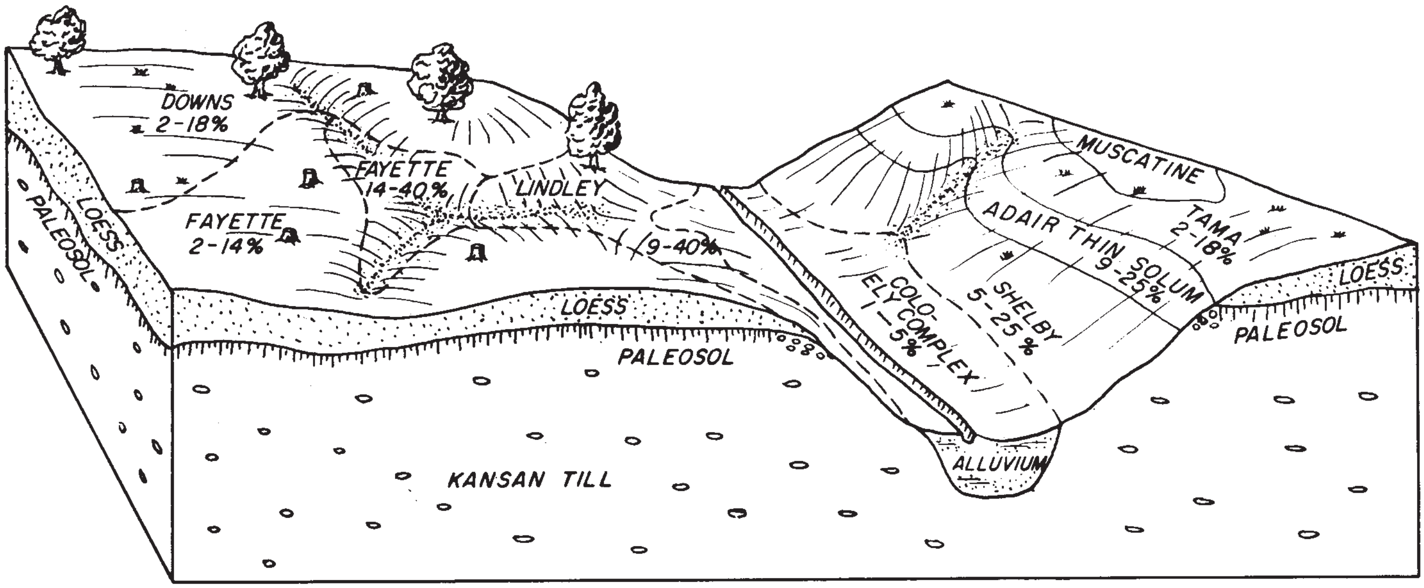


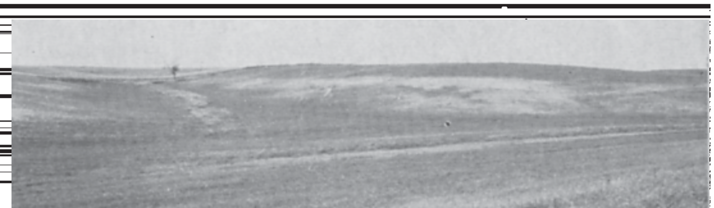
***Figure 5.*—Diagram showing topography and parent material of important soils in soil associations 4 and 7, and the relationship of these soils to other soils in the county.**

The soils in this association are used intensively for row crops. Consequently, large amounts of fertilizer are used. Land values range from high to low and are much more variable than in the other soil associations.

4. Tama-Downs-Shelby association

Nearly level to steep, dark colored and moderately dark

Downs soils are well suited to terracing because they typically have long uniform slopes and a comparatively fertile permeable subsoil. The Shelby and Gara soils are less well suited because their slopes commonly are steep and irregular, and their subsoil is low in fertility. Tile drains are needed on the sides of most waterways to control seepage.



some farms. Most of the grain that is grown is fed to livestock.

The fields in this association commonly form a rectangular pattern. However, contour fields are becoming increasingly noticeable. County roads ordinarily follow section lines but deviate in places because of the topography. Except for some groves of trees around farmsteads, most trees are scattered along waterways and fence rows.

Most of the farm buildings are well kept and are occupied. Farms, as a rule, are between 200 and 240 acres in size, but many farmers farm more than one unit or farm parts of other units.

The soils in this association range from high to low in fertility. On most farms, yields are average or above average. Large amounts of nitrogen, phosphate, and potash are used, and lime commonly is applied before legumes are seeded.

[redacted]

5 Chelsea-Fayette-Hagener-Tama association

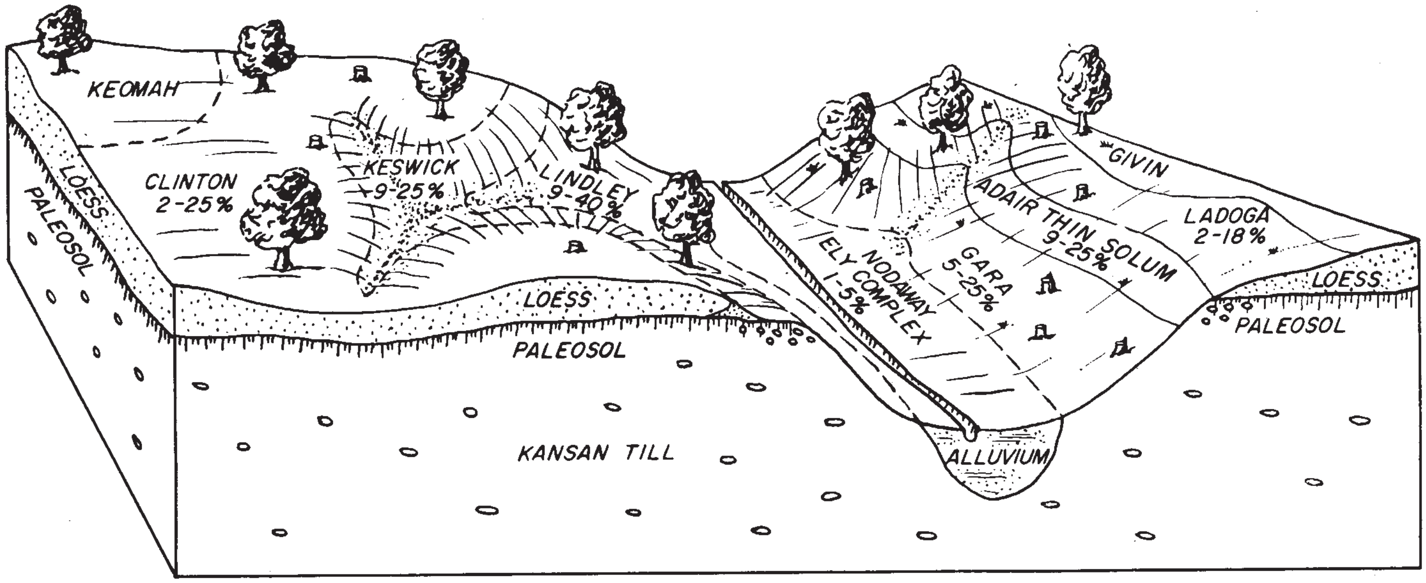


Figure 8.—**Diagram showing topography and parent material of soils in soil association 6, and the relationship of these soils to other soils in the county.**

too steep for terracing. Thus, the dominant erosion control practices are tilling on the contour, stripcropping on

can be grown more frequently and use this land for pasture. Most county roads follow section lines; a few fol-

rolling and hilly (see fig. 5). Narrow, steep-sided valleys that drain to the Iowa River and its tributaries are also characteristic of this association. Trees are scattered along roads, fence lines, and drainageways, and small groves are around farmsteads. In places patches of oak-hickory type forest remain from the native vegetation. These patches of forest and the wide distribution of trees are distinctive features of the landscape.

The Fayette and Downs soils are dominant in this association. The Downs soils are darker colored than the Fayette and generally are on the more gentle slopes. The Fayette soils are on rounded fingerlike ridges and on steep U-shaped side slopes. The Lindley and Nodaway soils are of minor extent. In places the Lindley soils are near the base of steep slopes; the Nodaway soils are along the many waterways that dissect this association. Deep, active, tree-lined gullies are numerous and in many places separate one part of a farm from the other. Consequently,

consists largely of undulating areas, with distinct stream channels and almost no depressions where shallow ponds can form. The drainageways are concave and are less entrenched than those in all the other associations, except 7 and 9. The low, smooth, rounded slopes give this association a distinctly different topography from the rest of the county. The borders are hilly and are strongly dissected. This association includes what geologists call the Iowan till plain. The glacial till in this part of the county is dominantly loam, whereas in other parts it is typically clay loam. A pebble band, or stone line, commonly occurs at a depth of 2 or 3 feet and generally can be seen in road cuts.

Most of the soils in this association developed from glacial till or from loess over glacial till. The loess, or silty material, occurs on most of the more gently sloping convex ridges and ranges from 20 to 40 inches in thickness over the till. The till crops out on side slopes. The soils

9. Mahaska-Taintor-Givin association

Nearly level, somewhat poorly and poorly drained soils that formed from loess on uplands

This association is in the southern two-thirds of the county. It forms the major divides between the English and Iowa Rivers and between Old Mans Creek and the Iowa and English Rivers. These divides are remnants of a former level plain but are now the highest part of the landscape (see fig. 3). They are from 1 to 5 miles apart

from this typical profile, the differences are stated in the description of the mapping unit, or they are apparent in the name of the mapping unit. Some technical terms are used in describing soil series and mapping units, simply because there are no nontechnical terms that convey precisely the same meaning. Many of the more commonly used terms are defined in the Glossary.

The acreage and proportionate extent of the mapping units are shown in table 1. Detailed technical descriptions of soil series are given in the section "Genesis, Classifica-

TABLE 1.—*Approximate acreage and proportionate extent of soils*

Soil	Acres	Percent
Adair clay loam, 5 to 9 percent slopes, moderately eroded	278	0.1
Adair clay loam, 9 to 14 percent slopes, moderately eroded	2,322	.6
Adair clay loam, 14 to 18 percent slopes, moderately eroded	532	.1
Adair clay loam, thin solum, 9 to 14 percent slopes, moderately eroded	2,806	.8
Adair clay loam, thin solum, 14 to 18 percent slopes, moderately eroded	1,513	.4
Adair soils, 9 to 14 percent slopes, severely eroded	1,735	.5
Adair soils, 14 to 18 percent slopes, severely eroded	627	.2
Adair soils, thin solum, 9 to 14 percent slopes, severely eroded	1,564	.4
Adair soils, thin solum, 14 to 18 percent slopes, severely eroded	2,431	.7
Adair soils, thin solum, 18 to 25 percent slopes, severely eroded	453	.1
Alluvial land	11,241	3.0
Amana silt loam	3,456	.9
Amana-Lawson-Nodaway complex	2,663	.7
Atterberry silt loam	665	.2
Atterberry silt loam, benches	299	.1
Bassett loam, 5 to 9 percent slopes, moderately eroded	932	.2
Bassett loam, 9 to 14 percent slopes, moderately eroded	366	.1
Bassett loam, 14 to 18 percent slopes, moderately eroded	108	(1)
Bassett loam, 18 to 25 percent slopes, moderately eroded	70	(1)
Bassett soils, 9 to 14 percent slopes, severely eroded	262	.1
Bassett soils, 14 to 18 percent slopes, severely eroded	159	(1)
Bertrand silt loam, 0 to 2 percent slopes	151	(1)
Bertrand silt loam, 2 to 5 percent slopes	452	.1
Bertrand silt loam, 5 to 9 percent slopes, moderately eroded	140	(1)
Bremer silty clay loam	5,874	1.6
Bremer silt loam, overwash	397	.1
Chariton silt loam	620	.2
Chelsea fine sand, 2 to 9 percent slopes	221	.1
Chelsea fine sand, 9 to 18 percent slopes	464	.1
Chelsea fine sand, 18 to 40 percent slopes	187	.1
Chelsea-Fayette-Lamont complex, 5 to 9 percent slopes	891	.2
Chelsea-Fayette-Lamont complex, 9 to 14 percent slopes	606	.2
Chelsea-Fayette-Lamont complex, 9 to 14 percent slopes, moderately eroded	1,296	.3
Chelsea-Fayette-Lamont complex, 14 to 18 percent slopes	322	.1
Chelsea-Fayette-Lamont complex, 14 to 18 percent slopes, moderately eroded	1,335	.4
Chelsea-Fayette-Lamont complex, 18 to 40 percent slopes	1,935	.5
Clinton silt loam, 2 to 5 percent slopes	2,689	.7
Clinton silt loam, 5 to 9 percent slopes	429	.1
Clinton silt loam, 5 to 9 percent slopes, moderately eroded	8,959	2.4
Clinton silt loam, 9 to 14 percent slopes	680	.2
Clinton silt loam, 9 to 14 percent slopes, moderately eroded	11,008	2.9
Clinton silt loam, 14 to 18 percent slopes, moderately eroded	3,231	.9
Clinton silt loam, 18 to 25 percent slopes, moderately eroded	694	.2
Clinton soils, 9 to 14 percent slopes, severely eroded	3,340	.9
Clinton soils, 14 to 18 percent slopes, severely eroded	2,025	0.5
Colo silty clay loam	5,038	1.3
Colo silt loam, overwash	9,137	2.5
Colo-Ely complex, 1 to 5 percent slopes	25,143	6.7
Coppock silt loam	159	(1)
Dickinson sandy loam, 0 to 2 percent slopes	257	.1
Dickinson sandy loam, 2 to 5 percent slopes	318	.1
Dickinson sandy loam, 5 to 9 percent slopes	190	.1
Dinsdale silty clay loam, 2 to 5 percent slopes	936	.3
Dinsdale silty clay loam, 5 to 9 percent slopes	653	.2
Downs silt loam, 2 to 5 percent slopes	2,168	.6
Downs silt loam, 5 to 9 percent slopes	919	.2
Downs silt loam, 5 to 9 percent slopes, moderately eroded	5,385	1.4
Downs silt loam, 9 to 14 percent slopes, moderately eroded	5,582	1.5
Downs silt loam, 14 to 18 percent slopes, moderately eroded	1,280	.3
Downs silt loam, benches, 2 to 5 percent slopes	331	.1
Downs soils, 9 to 14 percent slopes, severely eroded	466	.1
Downs soils, 14 to 18 percent slopes, severely eroded	649	.2
Ely silt loam, 2 to 5 percent slopes	5,797	1.6
Fayette silt loam, 2 to 5 percent slopes	1,971	.5
Fayette silt loam, 5 to 9 percent slopes	1,754	.5
Fayette silt loam, 5 to 9 percent slopes, moderately eroded	4,726	1.3
Fayette silt loam, 9 to 14 percent slopes	1,591	.4
Fayette silt loam, 9 to 14 percent slopes, moderately eroded	4,384	1.2
Fayette silt loam, 14 to 18 percent slopes	716	.2
Fayette silt loam, 14 to 18 percent slopes, moderately eroded	2,123	.6
Fayette silt loam, 18 to 25 percent slopes	1,525	.4
Fayette silt loam, 18 to 25 percent slopes, moderately eroded	2,663	.7
Fayette silt loam, 25 to 40 percent slopes	4,142	1.1
Fayette silt loam, benches, 2 to 5 percent slopes	222	.1
Fayette soils, 9 to 14 percent slopes, severely eroded	1,668	.4
Fayette soils, 14 to 18 percent slopes, severely eroded	2,533	.7
Fayette soils, 18 to 25 percent slopes, severely eroded	1,758	.5
Gara loam, 5 to 9 percent slopes, moderately eroded	120	(1)
Gara loam, 9 to 14 percent slopes, moderately eroded	1,120	.3
Gara loam, 14 to 18 percent slopes, moderately eroded	2,072	.6
Gara loam, 18 to 25 percent slopes, moderately eroded	867	.2
Gara soils, 9 to 14 percent slopes, severely eroded	349	.1
Gara soils, 14 to 18 percent slopes, severely eroded	2,011	.5
Gara soils, 18 to 25 percent slopes, severely eroded	1,087	.3
Givin silt loam	1,206	.3
Gullied land	363	.1
Hagener fine sand, 0 to 2 percent slopes	155	(1)
Hagener fine sand, 2 to 5 percent slopes	438	.1
Hagener fine sand, 5 to 9 percent slopes	826	.2
Hagener fine sand, 9 to 14 percent slopes	526	.1
Hagener fine sand, 14 to 25 percent slopes	194	.1
Hagener-Tama complex, 2 to 5 percent slopes	198	.1
Hagener-Tama complex, 5 to 9 percent slopes	382	.1
Hagener-Tama complex, 5 to 9 percent slopes, moderately eroded	475	.1

See footnote at end of table.

TABLE 1.—*Approximate acreage and proportionate extent of soils*—Continued

Soil	Acres	Percent
Hagener-Tama complex, 9 to 14 percent slopes, moderately eroded	1, 158	0. 3
Hagener-Tama complex, 14 to 18 percent slopes, moderately eroded	521	. 1
Hopper silt loam, 9 to 14 percent slopes, moderately eroded	227	. 1
Hopper silt loam, 14 to 18 percent slopes, moderately eroded	180	(1)
Hopper silt loam, 14 to 18 percent slopes, severely eroded	135	(1)
Hopper silt loam, 18 to 25 percent slopes, moderately eroded	261	. 1
Jackson silt loam	902	. 2
Nodaway-Ely complex	11, 283	3. 0
Otley silty clay loam, 2 to 5 percent slopes	15, 715	4. 2
Otley silty clay loam, 5 to 9 percent slopes	2, 401	. 6
Otley silty clay loam, 5 to 9 percent slopes, moderately eroded	17, 321	4. 6
Otley silty clay loam, 9 to 14 percent slopes, moderately eroded	10, 889	2. 9
Otley silty clay loam, 9 to 14 percent slopes, severely eroded	604	. 2
Otley silty clay loam, 14 to 18 percent slopes, moderately eroded	282	. 1
Otley silty clay loam, benches, 2 to 5 percent slopes	138	(1)

cultivated, this soil needs to be farmed on the contour. Seedbeds are difficult to prepare, and yields of corn are low. Gullies may develop unless measures are taken to prevent further erosion. Grazing needs to be controlled. *Capability unit IVe–3.*

Adair clay loam, 14 to 18 percent slopes, moderately eroded (AaE2).—The surface layer of this soil is very dark grayish-brown clay loam and is from 3 to 6 inches thick. The subsoil of reddish gritty clay is thick and distinct.

This soil generally occurs next to the Shelby soils. It is suited to hay and pasture or as a wildlife habitat. Applications of manure and commercial fertilizer are needed to establish stands of grasses and legumes, but yields generally are low. Gullies may form if grazing is not controlled. *Capability unit VIe–3.*

Adair clay loam, thin solum, 9 to 14 percent slopes, moderately eroded (AcD2).—This soil has a 3- to 6-inch

Diversions may be needed if the runoff from higher areas is excessive. If properly managed, this soil can be used intensively for corn and other row crops. *Capability unit I–1.*

Bassett Series

The Bassett series consists of moderately well drained, moderately dark colored soils, that developed from loamy sediments underlain by loam to clay loam glacial till. There is a distinct stone line at a depth of 10 to 20 inches. These soils occur mainly on long smooth slopes, on uplands in the northeastern part of the county. The slope ranges from 5 to 25 percent but is predominantly between 5 and 14 percent.

Representative profile:

brown surface layer. In most plowed areas subsoil material is mixed with the surface soil. Included in the areas mapped are small areas of soils that have a silt loam texture to a depth of 20 inches. Also included are some soils that have a very dark gray surface layer, and some uneroded soils that are used as pasture or woodland.

Control of erosion is difficult if this soil is cultivated because slopes are irregular and are moderately steep. This soil is suitable for hay and pasture. Row crops should be grown only when reestablishing hay or pasture. If row crops are grown, contouring and stripcropping are needed to help control erosion. This soil is too steep for terraces. *Capability unit IVe–1.*

Bassett loam, 18 to 25 percent slopes, moderately eroded (BaF2).—This soil has a very dark gray to very dark grayish-brown surface layer that is 3 to 6 inches the Jackson and Koszta soils. The slope ranges from 0 to 9 percent.

Representative profile:

0 to 7 inches, dark-gray to dark grayish-brown silt loam; friable.
7 to 10 inches, dark grayish-brown to dark-brown silt loam; friable.
10 to 42 inches, dark-brown to yellowish-brown silt loam to silty clay loam; friable.
42 to 55 inches, yellowish-brown silt loam; some strata of sand; friable.

The Bertrand soils are moderately permeable, are high in moisture-holding capacity, and are low in organic-matter content. They are medium or strongly acid and need lime. They are very low in available nitrogen and low in phosphorus and potassium. The response to commercial fertilizer is fair or good. The more strongly sloping soils are readily eroded.

Bertrand silt loam, 0 to 2 percent slopes (BrA).—This soil occurs on nearly level second bottoms and generally is not subject to overflow, except during periods of abnormally high rainfall.

Although this soil tends to puddle readily, it can be used intensively for row crops. A rotation that includes grasses and legumes helps to increase the organic-matter

The major limitation on these soils is wetness caused by flooding and by a high water table. Although tile drains generally function satisfactorily, planting may be delayed in spring because of wetness. These soils are high in organic-matter content and if adequately drained are productive. They are low in nitrogen and low or medium in phosphorus and potassium. They are slightly acid.

Bremer silty clay loam (Bs).—This soil is extensive in the county. It has a slope of 1 percent or less and is occasionally overflowed. It puddles readily when wet and is cloddy and hard when dry. The water table is high.

Tile functions in this soil, but in some areas surface drains are needed to remove surface water. If drained and otherwise well managed, this soil is productive and can be used intensively for row crops. Plowing often is delayed in spring because of wetness. Consequently, most areas are plowed in fall. If this soil is used intensively for crops, lime and fertilizer are needed. *Capability unit IIw-2.*

Bremer silt loam, overwash (Bt).—A profile of this soil is similar to the profile described as representative of the series, except that in most places from 4 to 20 inches of very dark brown silt loam has been deposited over the black silty clay loam. In some places, lighter colored ma-either because the water table is high or the soil is ponded. Row crops are suitable if this soil is drained, but crops sometimes are short or turn yellow because of excess moisture. Yields vary but generally are moderate if management is good. This soil needs better management than the

from erosion and have as much as 1½ inches of leaf litter on the surface.

This soil is so steep that in many places it cannot be renovated with regular farm machinery. Thus, pasture yields are low. This soil is suitable for woods or wildlife

This complex is not suited to row crops but is suitable for pasture or woods. Measures to control erosion need to be taken when pastures are renovated. Applications of lime, fertilizer, and organic matter are also needed. The carrying capacity for pastures is low during most of the year, and gullies may develop if grazing is not controlled. *Capability unit VIe-2.*

Chelsea-Fayette-Lamont complex, 14 to 18 percent slopes, moderately eroded (CfE2).—This complex has been used mainly for cultivated crops. It is eroded to the extent that there are many areas where the subsoil is exposed.

Because this complex is moderately steep and erodes rapidly if cultivated, it is better suited to permanent pasture, woods, or wildlife habitats. Yields vary but generally are low. *Capability unit VIe-2.*

Chelsea-Fayette-Lamont complex, 18 to 40 percent

Some areas are used as pasture or woodland, but most of the acreage is used for crops. Corn, oats, and hay are the principal crops. This soil is readily eroded and needs to be tilled on the contour if row crops are grown. Yields are favorable if management is good. *Capability unit IIe-2.*

Clinton silt loam, 5 to 9 percent slopes (ClC).—This soil has a 2- to 4-inch surface layer of very dark gray silt loam that is underlain by dark grayish-brown silt loam. In cultivated areas, the surface layer is very dark gray or dark gray. Included in the areas mapped are small areas on loess-covered benches.

Much of the acreage is pastured or wooded. Although this soil is readily eroded if cultivated, in most cultivated fields measures are taken to control erosion. Consequently, little of the surface soil has been lost. Row crops can be grown more frequently where fields are terraced most places subsurface material is mixed with the surface soil. Included in the areas mapped is a small acreage of a less eroded soil that is wooded and thus is protected from erosion. In these areas, the soil has a 3-inch, very dark gray surface layer and a distinct dark grayish-brown subsurface layer.

If this soil is used for corn, soil loss is high and yields are low. This soil is suitable for semipermanent hay or pasture. A row crop can be grown for 1 year, however, [illegible] pastures need renovating if fields are strip-

Permeability is moderately slow on the Colo soils, and tile drains are needed to reduce the wetness hazard caused by slow runoff and a high water table. If drained, these soils are productive and can be used intensively for row crops. They are low or medium in available nitrogen, medium in phosphorus, and low or medium in potassium. They are slightly acid and may not need lime. The response to management is good.

Colo silty clay loam (Co).—A profile of this soil is similar to the one described as representative of the series.

Figure 12.—**Wetness on the Colo-Ely complex, 1 to 5 percent slopes, will be reduced by installation of tile lines.**

ceptor tile is needed to drain this soil, and in other places diversions are needed to intercept runoff.

This soil commonly occurs in small areas and is cropped with adjacent soils. Moderate yields of corn and soybeans can be expected if management is good. At times field operations are delayed slightly after rains. *Capability unit IIw-1.*

Dickinson Series

The Dickinson series consists of well-drained or somewhat excessively drained, dark colored or moderately dark colored soils on uplands. These soils formed from moderately coarse textured material and are underlain at a depth of 20 to 36 inches by coarse and fine sand. They occur in nearly level to sloping areas on river benches and on adjoining uplands. They are associated mainly with the Hagener soils.

Representative profile:

0 to 15 inches, black to very dark brown sandy loam; very friable.

15 to 30 inches, very dark grayish-brown to brown sandy loam; very friable.

30 to 52 inches, yellowish-brown and brown loamy sand; some layers of loam; loose to friable.

The Dickinson soils are rapidly permeable, have low

Dickinson sandy loam, 5 to 9 percent slopes (DcC).—This soil occurs mainly on uplands near the Iowa River valley. A few moderately eroded areas in which the surface layer is very dark grayish brown are included in the areas mapped.

This soil is rapidly permeable. Consequently, runoff is slow except during periods of intense rain. The organic-

Downs Series

The Downs series consists of well-drained, moderately dark colored soils derived from loess. These soils occur mainly on ridgetops and sides slopes on the uplands. A few areas are on loess-covered benches along large streams. The slope ranges from 2 to 18 percent.

commonly is mixed with the plow layer. Included in the areas mapped are small areas of soils that have a 4- to 8-inch very dark gray surface layer and a somewhat distinct dark grayish-brown subsurface layer.

Although some areas are used for pasture or woods, this soil is suited to crops. It is low in organic-matter content and is readily eroded but responds to good management. The improvement of waterways is essential because runoff is rapid. If cultivated, this soil needs to be tilled on the contour. Row crops can be grown more frequently where fields are terraced. Yields of corn are moderate. *Capability unit IIIe-3.*

Downs silt loam, 14 to 18 percent slopes, moderately eroded (DoE2).—This soil has a 3- to 6-inch surface layer of very dark brown to very dark grayish-brown silt loam. Subsurface material commonly is mixed with the surface layer. In many places the subsoil of silty clay loam is thinner than that of the typical Downs soil. Included in the areas mapped are a few small areas of a less eroded soil that has a thicker dark-colored surface layer.

Runoff is rapid on this soil, slopes are moderately steep, and tilth is somewhat poor. Consequently, this soil is susceptible to severe sheet erosion and needs to be tilled

subsoil is exposed. In places there is a 3-inch dark grayish-brown surface layer, but generally the present surface layer is brown silty clay loam.

These soils have poor tilth and are very low in organic-matter content. They puddle readily when wet, and they become cloddy and hard when dry. Consequently, seedbeds generally are difficult to prepare. Runoff is very rapid, and waterways and diversion terraces are needed to help control erosion. Row crops are not suitable, but small grain can be grown when pastures are renovated. Additions of fertilizer and organic residues help new seedings to become established. If management is good, hay and pasture yields are moderate. *Capability unit VIe-1.*

Ely Series

The Ely series consists of somewhat poorly drained, dark-colored soils derived from mixed sediments that washed from adjacent hillsides. These soils occur either as long, narrow, irregular bands between the toe slopes and flood plains of narrow waterways on the uplands, or as alluvial fans where small streams have deposited sediments on large flood plains (fig. 13). The slope ranges

son soils, sand has accumulated on the surface. These areas are indicated on the soil map by sand symbols.

The Ely soils respond to good management and are productive. They are medium in available nitrogen and phosphorus and low or medium in potassium. They are slightly acid or medium acid.

Ely silt loam, 2 to 5 percent slopes (EsB).—This soil has a 20- to 30-inch surface layer of black to very dark gray silt loam. In a few included areas, the soil is black to a depth of 40 inches. Most areas have some light-colored silty overwash on the surface.

This soil generally occurs as small areas and is cropped and managed with adjacent soils. Wetness and siltation are the principal hazards because of seepage and runoff from adjacent slopes. Interceptor tile helps to remove seepage water but needs to be carefully placed to function properly. Spots where runoff water concentrates are subject to gully erosion. Diversions are needed in these areas to intercept runoff. This soil can be used intensively for row crops if it is terraced, tilled on the contour, and protected from seepage. If management is good, better than

soil when the adjoining steeper Fayette soils are terraced. Yields of corn are above average if management is good. *Capability unit IIe-2.*

Fayette silt loam, 5 to 9 percent slopes (FaC).—This soil occurs mainly on convex side slopes and on narrow rounded ridgetops. A few areas are on the side slopes of high benches. The surface layer is very dark-brown to very dark grayish-brown silt loam. The subsurface layer is dark grayish brown and distinct.

This soil is susceptible to erosion, and it is low in organic-matter content. It is easy to cultivate, however, and most of the acreage is cultivated. If row crops are grown, tillage needs to be done on the contour. Row crops can be grown more frequently where fields are terraced. Because of the uniform length and shape of the slopes, most areas are suitable for terracing. Additions of organic matter are beneficial. *Capability unit IIIe-2.*

Fayette silt loam, 5 to 9 percent slopes, moderately eroded (FaC2).—This soil occurs mainly on convex slopes of the uplands. A few areas are on benches. The surface layer consists of 3 to 6 inches of very dark grayish-brown of organic matter are beneficial. Moderate yields of corn can be obtained if management is good. *Capability unit IIIe-4.*

Fayette silt loam, 14 to 18 percent slopes (FgE).—This

clay loam is thinner than that of the less sloping Fayette soils. Slopes are long and vary in shape. Gullies have formed in some places.

This soil is readily eroded by runoff. Diversion terraces the contour. Row crops can be grown more frequently where fields are terraced. Applications of organic matter and fertilizer are needed to establish seedings. Yields of corn are moderately low, even if management is good. *Capability unit IVe–4.*

Fayette soils, 14 to 18 percent slopes, severely eroded (FsE3).—These soils occur on irregular complex slopes that are dissected by gullies and waterways. In a few places there is a 3-inch, dark grayish-brown surface layer, but in most places the surface layer consists of brown silty clay loam, or former subsoil. Numerous gullies, too deep to be crossed with farm machinery, have formed in some areas.

These soils are readily eroded by runoff. They have poor tilth, puddle if worked when wet, and become cloddy and hard when dry. Diversion terraces, constructed on these soils, help to prevent siltation of lower lying soils. The shaping and seeding of gullies will help to control runoff. Applications of organic matter are beneficial.

gen, phosphorus, and potassium. Nearly all are suitable sites for farm ponds.

Gara loam, 5 to 9 percent slopes, moderately eroded (GaC2).—This soil occurs on narrow ridgetops and on side slopes. In most places the surface layer is 3 to 6 inches of very dark grayish-brown loam. In some wooded or pastured areas, the surface layer is very dark gray. The brown subsoil is exposed in a few places.

This soil is readily eroded by runoff. Consequently, it needs to be tilled on the contour if row crops are grown. Row crops can be grown more frequently where fields are terraced. However, most areas are small, and these areas generally are farmed with adjacent soils. Additions of organic matter are beneficial. Ordinarily both lime and phosphate are needed to establish legumes. Yields of corn are moderately low, even if management is good. *Capability unit IIIe–1.*

Gara loam, 9 to 14 percent slopes, moderately eroded (GaD2).—This soil occurs on convex slopes that in many places are dissected by waterways. It has a 3- to 6-inch

Runoff is rapid on this soil, and barren areas are readily eroded. Thus, part of the old vegetation should be maintained when pastures are renovated. Brush control is needed in some places. Diversion terraces on this soil help to protect the soils downslope from runoff.

This soil is suited to permanent pasture, woods, and wildlife habitats, and it provides suitable sites for ponds. The management of wooded areas is discussed in the section "Management of Woodland." Control of grazing is necessary in pastured areas. The section "Management of Woodland" suggests suitable trees for planting, as well as management for woodland. *Capability unit VIIe-1.*

Givin Series

In the Givin series are somewhat poorly drained, level places this gullied land is idle. It commonly has only a thin cover of vegetation, or it is barren. It cannot be used for crops or pasture without extensive reclamation but will provide excellent habitats for wildlife if seeded to grasses and legumes or if trees are planted. Some areas need to be fenced to prevent their being grazed by livestock. Runoff can be intercepted before it reaches some of these gullied areas if diversions are constructed on soils upslope. *Capa-*

This soil is subject to both wind and water erosion. It needs to be tilled on the contour if row crops are grown. Crop residues left on the surface help to control wind erosion. A cover crop of winter rye also helps to reduce the erosion hazard. Grasses and legumes generally are difficult to establish but should be left on this soil as long as they are productive. However, rodents often become active and harm old seedings. Yields of corn are low.

This complex is erodible and droughty. Conservation

mapped are a few small areas in

Alfalfa grows well on this soil. Additions of phosphate are beneficial in establishing alfalfa stands. Row crops can be grown for 1 year if fields are stripcropped on the contour. Yields of corn are moderate, provided management is good. Diversion terraces that are constructed on this soil help to protect soils downslope from runoff.

in phosphorus, and low or very low in potassium. They are not extensive in the county and are often farmed with adjoining soils.

Jackson silt loam (Ja).—This soil occurs on nearly level bottoms and on gently sloping escarpments adjacent to these areas. In most places the surface layer is dark-gray silt loam. In places some of the former subsurface soil of corn are above average. Individual areas are small and are generally farmed with adjoining soils. *Capability unit IIe-1.*

Kenyon Series

The Kenyon series consists of moderately well drained, dark-colored soils that formed from medium-textured sediment over glacial till. These soils occur on convex slopes on uplands in the northeastern part of Washington and Lenox Townships. The slope ranges from 2 to 14 percent but is mostly between 3 and 7 percent.

Representative profile:

0 to 12 inches, very dark brown loam; friable.
12 to 18 inches, dark-brown loam; friable.
18 to 51 inches, dark-brown and brown loam; some stones and

This soil is readily eroded by runoff. Consequently, if used for row crops it needs to be tilled on the contour, stripcropped on the contour, or terraced. Row crops can be grown more frequently where fields are terraced. Where terraces are constructed, the depth of the cuts should be limited so as not to expose the subsoil, which is low in fertility. Yields of corn are favorable if management is good. *Capability unit IIIe-1.*

Kenyon loam, 9 to 14 percent slopes, moderately eroded (KnD2).—This soil occurs as discontinuous narrow bands on short convex slopes, below undulating uplands. The surface layer is very dark brown to very dark grayish-brown loam and is from 3 to 6 inches thick. Some soils that have a thicker dark-colored surface layer are included in the areas mapped. Also included are a few corn are better than average, if management is good. *Capability unit IIw-4.*

Keswick Series

The Keswick series consists of moderately well drained soils that formed from weathered reddish, gritty clay material of glacial origin. These soils occur as narrow bands on convex side slopes, on uplands. They are downslope from the Clinton and Ladoga soils and upslope from the Lindley and Gara soils. The slope ranges from 9 to 25 percent. A few small areas of Lindley and Clinton soils are included in the areas mapped.

Representative profile:

0 to 6 inches, very dark grayish-brown loam; friable.
6 to 13 inches, brown loam; few strong-brown mottles or oxides; friable.
13 to 33 inches, yellowish-red, dark-brown to brown, and strong-brown clay loam to gritty clay; firm.
33 to 65 inches, dark yellowish-brown and yellowish-brown clay loam; a few strong-brown and grayish-brown mottles; firm.

The Keswick soils are readily eroded by runoff and are gullied in some places. They have a slowly permeable subsoil, and some areas are seepy in spring. The organic-matter content is low. These soils are medium or strongly acid, and they are low or very low in available nitrogen, phosphorus, and potassium. They are poorly suited to row crops but can be used for hay and pasture. Farm ponds to supply water for livestock can be constructed in these soils.

Keswick loam, 9 to 14 percent slopes, moderately eroded (KsD2).—This soil occurs mainly as narrow bands on convex side slopes. In places it occupies entire short

to form waterways will help to control further erosion. This soil is suited to pasture and to wildlife habitats. Additions of organic matter, fertilizer, and lime are needed to establish pasture stands. The carrying capacity of pastures is moderate, but grazing needs to be controlled. *Capability unit VIe-3.*

Keswick loam, 18 to 25 percent slopes, moderately eroded (KsF2).—This soil has a 3- to 6-inch surface layer of brown to very dark grayish-brown loam. In many places the former subsurface layer is mixed with the surface soil. Included in the areas mapped are a few timbered areas in which the surface layer is darker colored than that of this soil, and there is a distinct brown subsurface layer.

This soil is readily eroded by runoff if vegetation is lacking. Diversion terraces are needed to divert water away from gullied areas. Although most of the acreage has been cultivated, this soil is now used mainly for permanent pasture. The carrying capacity of pastures is low, however, and control of grazing is necessary. When pastures are renovated, excessive soil loss can be prevented if part of the old vegetation is allowed to remain while new vegetation is being established. The removal of brush is necessary in some areas. This soil is suited to pasture, woods, and wildlife habitats. Management of wooded areas is discussed in the section "Management of Woodland." *Capability unit VIIe-1.*

Keswick soils, 9 to 14 percent slopes, severely eroded (KwD3).—These soils occur on short, convex side slopes and commonly are dissected by gullies and waterways. They are so severely eroded that in most places the present surface layer consists of brown or yellowish-red gritty clay, or former subsoil. In a few places about 3 inches or less of brown loam or clay loam remains. The original brown-low. These soils are suited to woods and wildlife habitats. Management of wooded areas is discussed in the section "Management of Woodland." *Capability unit VIIe-1.*

Keswick soils, 18 to 25 percent slopes, severely eroded (KwF3).—These soils occur on irregular, convex short slopes

Ladoga Series

The Ladoga series consists of moderately well drained, moderately dark colored soils derived from loess. These soils occur on uplands and on benches along streams. They

Figure 14.—**Ladoga silt loam, 5 to 9 percent slopes, moderately eroded, on side slopes. Darker colored Ely soil in drainageways.**

Cultivated areas are readily eroded by runoff, and most areas are dissected by a few waterways. Consequently, if row crops are grown, this soil needs to be tilled on the contour, stripcropped on the contour, or terraced. If terraced, it can be used more frequently for row crops. Additions of organic matter are beneficial. The shaping and seeding of waterways will help control further erosion. Yields of corn are moderate if management is good. Diversion terraces, constructed on the benches, help to protect soils downslope from runoff. *Capability unit IIIe-1.*

Ladoga silt loam, 9 to 14 percent slopes (LaD).—This soil occurs on moderately long, convex side slopes and to a lesser extent on loess benches. It has a 6-inch surface layer of very dark gray to very dark brown silt loam and a distinct lighter colored subsurface layer. In wooded areas, there generally is a thin layer of leaf litter on the surface, and the surface layer is from 4 to 8 inches thick and very dark gray.

This soil is readily eroded by runoff if vegetation is thin or lacking, and in many places it is dissected by waterways. Waterways can be shaped and seeded to prevent further erosion. If row crops are grown, this soil needs to be tilled on the contour, stripcropped on the contour, or terraced. It is well suited to terraces and can be used more frequently for row crops if fields are terraced. Additions of organic matter are beneficial. Yields of corn are moderate if management is good. *Capability unit IIIe-3.*

Ladoga silt loam, 9 to 14 percent slopes, moderately eroded (LaD2).—This soil occurs on moderately long, convex side slopes and to a lesser extent on loess benches. It has a 3- to 6-inch surface layer of very dark grayish-brown silt loam or silty clay loam. In places the former lighter colored subsurface soil is mixed with the surface layer.

This soil has a somewhat poorly granulated surface layer and is readily eroded by runoff. Consequently, if row crops are grown, it needs to be tilled on the contour, stripcropped on the contour, or terraced. Because of the length and uniformity of the slopes, it is well suited to both stripcropping and terracing. Row crops can be grown more frequently in fields that are terraced. Yields of corn are moderate if management is good. If tilth is poor, grasses and legumes can be grown more frequently, or organic matter can be added. The shaping and seeding of waterways will help to prevent further erosion. *Capability unit IIIe-3.*

Ladoga silt loam, 14 to 18 percent slopes, moderately eroded (LaE2).—This soil occurs on long, convex slopes that are dissected by waterways. It has a 3- to 6-inch surface layer of silt loam to silty clay loam. In places the former lighter colored subsurface soil is mixed with the surface layer. The subsoil commonly is thinner than that of the less sloping Ladoga soils. One area in which the slope is as much as 20 percent was included in mapping. Also included are a few small areas of a less eroded soil that has a darker colored surface layer than this soil.

Runoff on this soil is rapid, and erosion is a serious hazard in areas where vegetation is thin or lacking. This soil is used principally for hay and pasture. A row crop can be grown for 1 year when stands are renovated. Yields of corn are moderately low, even if management is good. Stripcropping on the contour helps to reduce soil loss when row crops are grown. Gullies and waterways can be shaped and seeded to prevent their being further eroded. This soil provides suitable sites for ponds. *Capability unit IVe-1.*

Ladoga silt loam, benches, 2 to 5 percent slopes (LbB).—This soil occurs on high benches, adjacent to major streams in the county, but mainly along the English River. It is not subject to overflow by streams, but in places it receives runoff from soils upslope. A small acreage of a somewhat poorly drained soil is included in the areas mapped.

This soil is similar to the typical Ladoga soil, except that in many places a sandy substratum occurs at a depth of 48 to 60 inches. Diversion terraces, constructed on soils upslope, will help to protect this soil from runoff. This soil needs to be tilled on the contour if row crops are grown. If terraced, it can be used intensively for row crops. Additions of organic matter or the use of a rotation that includes grasses and legumes is beneficial in areas where tilth is poor. Yields of corn are favorable if management is good. *Capability unit IIe-1.*

Ladoga soils, 9 to 14 percent slopes, severely eroded (LdD3).—Except for one area, which is on a loess bench, these soils occur between waterways, on somewhat short convex knobs. They are so severely eroded that, in most places, the present surface layer consists of brown silty clay loam, or former subsoil. There are a few areas in which about 3 inches of the original surface layer of very dark grayish-brown silt loam to silty clay loam remains.

These soils are readily eroded by runoff. They have a moderately slow rate of water intake, are low in organic-matter content, and have poor tilth. If row crops are grown, fields need to be tilled on the contour, stripcropped on the contour, or terraced. The long slopes are suited to stripcropping. Terraces can be constructed in most places. Yields of corn are moderately low, even if management is good. Lime and fertilizer are needed to establish stands of grasses and legumes. Additions of organic matter are beneficial. *Capability unit IVe-4.*

Ladoga soils, 14 to 18 percent slopes, severely eroded (LdE3).—These soils occur on short convex knobs on irregular side slopes, between waterways. They have been so severely eroded that, in most places, the present surface layer consists of brown silty clay loam, or former subsoil. There are a few areas in which about 3 inches or less of the original surface layer of very dark grayish-brown silt loam to silty clay loam remains. Included in the areas mapped are a few small areas in which the gradient is as much as 20 percent.

These soils have been eroded by runoff and are gullied in some places. The gullies can be shaped and seeded if diversion terraces are placed above these areas to intercept runoff. The best use for these soils is hay and pasture. Oats can be grown as a nurse crop when stands are renovated. Additions of organic matter and applications of lime and fertilizer will help to establish seedings. The carrying capacity of pastures is moderate, and control of grazing is important. *Capability unit VIe–1.*

somewhat droughty. It can be used intensively for row crops, however, and, under good management, is highly productive of corn. Individual areas are small and commonly are farmed with adjoining somewhat better drained soils. *Capability unit I–1.*

Lawson Series

In the Lawson series are somewhat poorly drained, dark-colored soils that have formed from silty alluvium. These soils occur on nearly level to slightly undulating first bottoms that in some areas are dissected by meandering old channels.

Representative profile:

0 to 35 inches, black to very dark brown and very dark gray silt loam; friable.

35 to 68 inches, dark-gray, gray, and dark-brown silt loam; few strong-brown mottles; friable.

the cleared areas have been cultivated at one time, but many of these areas have been allowed to revert to permanent vegetation because they were not productive. These soils erode readily if cultivated and generally are best suited to pasture or woods. They provide suitable sites for farm ponds. Thus, water for livestock can be provided. Wildlife habitats can be established around ponds. These soils commonly are very low in available nitrogen and phosphorus and low or very low in potassium. They are acid and need lime unless limed within the past 5 years.

Lindley loam, 9 to 14 percent slopes, moderately eroded (LnD2).—This soil occurs on irregular convex side slopes that are dissected by waterways. It is downslope from the Keswick, Clinton, and Ladoga soils. The surface layer consists of 3 to 6 inches of dark grayish-brown to very dark grayish-brown loam. Most of the former light-colored subsurface soil is mixed with the present surface layer. Included in the areas mapped are some small wooded areas in which the soils have a thin layer of leaf litter on the surface, a slightly darker colored surface layer than this soil, and a distinct subsurface layer that is 4 to 8 inches thick. Also included are a few less sloping soils.

This soil is low in organic-matter content and has poor tilth. It is readily eroded by runoff if the vegetation is thin or is lacking. The rate of water intake is moderately slow or slow. This soil is best suited to hay or pasture but

The fencing of wooded areas will prevent trees being damaged by grazing. The numerous waterways and the shape and steepness of slopes make the renovation of pastures difficult. To help control erosion when pastures are renovated, part of the old vegetation can be maintained until new vegetation becomes established. Grazing needs to be controlled in pastures because the carrying capacity is low. The removal of brush is important in some areas. This soil provides suitable sites for farm ponds. Diversion terraces on this soil help to protect soils downslope from runoff. The section "Management of Woodland" gives some suggestions for the care of woodland. *Capability unit VIIe–1.*

Lindley loam, 18 to 25 percent slopes, moderately eroded (LnF2).—This is the principal Lindley soil in the county. It occurs on long, strongly dissected side slopes that border river valleys. Most areas are large. The surface layer of dark grayish-brown loam is 3 to 6 inches thick and, in most places, consists partly of former subsurface soil.

Although there are some scattered trees, particularly along waterways and fence rows, most of the acreage is used for permanent pasture. This soil is suited to limited grazing, woods, and wildlife habitats. Because of the steepness and shape of slopes, regular farm machinery cannot be used in places to renovate pastures. Therefore, the present grass vegetation should not be destroyed, al-

Nevin Series

to streams. Most areas are dissected by at least one stream that cannot be crossed with farm machinery. This soil is

uneroded soils are high in organic-matter content. The gently sloping Otley soils are among the most productive soils in the county.

Otley silty clay loam, 2 to 5 percent slopes (OcB).—This soil occurs on ridge crests, adjacent to the Mahaska soils, and on narrow convex ridgetops. The surface layer is black to very dark brown friable silty clay loam and is from 12 to 14 inches thick.

This soil is high in organic-matter content and has good tilth. It is readily eroded by runoff when crops are small or when the surface is barren. It needs to be tilled on the contour if row crops are grown, and it can be used inten-

Cultivated fields are readily eroded. Thus, if row crops are grown, tillage needs to be done on the contour. Corn can be grown more frequently if fields are terraced. The somewhat smooth, convex slopes generally are suited to terracing. The shaping and seeding of waterways will

loam. The subsoil is thinner than that of less sloping Otley soils. Included in the areas mapped are a few severely eroded areas of Otley soils that have a dark-brown to brown surface layer.

Runoff is very rapid on this soil, and consequently eroor terraced. Terraces are difficult to construct because of the shape and length of the slopes. Yields of corn are moderate if management is good. *Capability unit IIIe–1.*

Shelby loam, 5 to 9 percent slopes, moderately eroded (ShC2).—This soil occurs on narrow ridgetops and convex side slopes that are dissected by some waterways. The surface layer of very dark grayish-brown loam is 3 to 6 inches thick. Some severely eroded areas in which the surface layer is brown clay loam are included in the areas mapped. These areas are indicated on the soil map by a severe erosion symbol.

Runoff is moderately rapid on this soil. Consequently,

mapped. These areas are indicated on the soil map by erosion symbols.

Runoff is very rapid on this soil. The surface layer has poor tilth and generally is cloddy and hard when dry. Seedbeds are difficult to prepare. This soil is best suited to permanent pasture, woods, and wildlife habitats. Although the carrying capacity of pastures is moderate, control of grazing is necessary. Removal of shrubs will improve pastures. Gullies and waterways can be shaped and seeded. Diversion terraces, placed on this soil, will protect soils downslope from runoff. This soil provides suitable sites for ponds. The section "Management of Wood-

19 to 38 inches, dark gray heavy silty clay loam; common yel-

organic matter, lime, and fertilizer. If well managed it

Tama Series

The Tama series consists of well-drained, dark-colored soils that formed from loess mainly on convex ridgetops, ridge crests, and side slopes, on the uplands. A few areas are on loess-covered benches. The slope ranges from 2 to 18 percent but is mainly between 5 and 9 percent.

Representative profile:

0 to 15 inches, black to very dark brown and very dark grayish-brown silty clay loam; friable.
15 to 43 inches, dark-brown to brown silty clay loam; friable to firm.
43 to 67 inches, brown and yellowish-brown silt loam; few yellowish-brown and light grayish-brown mottles; friable.

The uneroded Tama soils are high in organic-matter content, have good tilth, and are easy to work. They absorb water at a moderate rate but are readily eroded by runoff. The less sloping soils are well suited to row crops and in most places are productive. The Tama soils are medium acid. They are low or medium in available nitrogen and low or very low in phosphorus and potassium. The response to fertilizer is good. Most of the acreage is cultivated.

Tama silty clay loam, 2 to 5 percent slopes (TcB).—A profile of this soil is similar to the one described as typical of the series. This soil occupies both gentle convex ridge crests on broad upland divides and moderately wide ridgetops in association with the Tama, Downs, and Shelby soils.

This is one of the most productive soils in the county. It is slightly susceptible to erosion, however, and needs to be tilled on the contour if row crops are grown. It

Yields of corn are favorable, provided management is good. Some individual areas of this soil are large enough to be farmed separately. *Capability unit IIIe-1.*

Tama silty clay loam, 9 to 14 percent slopes, moderately eroded (TcD2).—This is one of the major Tama soils in the county. It occurs on moderately long, smooth, convex side slopes and is dissected by a few waterways. The surface layer consists of 3 to 6 inches of very dark brown to very dark grayish-brown silty clay loam to silt loam. In places, at the shoulder of side slopes, the surface layer is only 3 inches thick. Included in the areas mapped are some Tama soils on short, convex side slopes of benches.

This soil has rapid runoff. If used for row crops, it needs to be tilled on the contour, stripcropped on the contour, or terraced to prevent excessive soil loss. Both stripcropping and terracing are suitable because of the length and smoothness of the slopes. Yields of corn are favorable if management is good. Some areas of this soil are large enough to be farmed separately. *Capability unit IIIe-3.*

Tama silty clay loam, 9 to 14 percent slopes, severely eroded (TcD3).—This soil occurs mainly on short rounded side slopes, between gullies and waterways. Some areas are on the shoulder of side slopes. All of the original dark-colored surface layer has been removed by sheet erosion, and the present surface layer consists mainly of dark-brown silty clay loam. At the base of slopes and near waterways are some areas in which the surface layer is darker colored and thicker than that of this soil.

This soil is low in organic-matter content and commonly becomes cloddy and moderately hard when dry. The surface may seal when wet. Runoff is rapid, and some

layer is gray to dark grayish brown. In most places sand occurs at a depth of 24 to 30 inches. Included in the areas mapped are a few areas in which less than 3 inches of the original surface layer remains and the brown subsoil is exposed.

This soil has low moisture-holding capacity. It generally is slightly more droughty than the less eroded and near waterways. In years of below average rainfall, this soil is likely to be somewhat droughty.

This soil can be used intensively for row crops if fertility is maintained. Additions of organic matter are beneficial. A few areas are large enough to be farmed separately. Others are farmed with surrounding soils. Yields of corn vary but generally are above average. *Capability unit I–1.*

nitrogen, low or medium in phosphorus, and very low in potassium.

Walford silt loam, benches (Wb).—This soil occurs in flat or depressed areas, on high benches along the Iowa River. The slope is less than 1 percent. The surface layer is very dark gray, friable silt loam and is from 6 to 10 inches thick. The subsurface layer is grayish-brown silt

Although there is some runoff on this soil, control of erosion is not a serious problem. However, tillage needs to be done on the contour if row crops are grown. In a few areas, runoff that originates on soils upslope collects on this soil. This water can be intercepted by constructing diversion terraces on the higher lying soils. Most areas of this soil are too small to be farmed sep-

Waukegan Series

The Waukegan series consists of well-drained or somewhat excessively drained, dark-colored soils that are underlain by fine and medium sand at a depth of 20 to 40 inches. These soils occur mainly on stream benches along the Iowa River and some tributaries. Some areas are on adjoining uplands, near the Amana Colonies. The slope ranges from 0 to 9 percent but is mostly between 0 and 5 percent.

Representative profile:

0 to 16 inches, very dark brown and dark-brown loam to silt loam; friable.
16 to 33 inches, brown silty clay loam and loam; friable.
33 to 60 inches, yellowish-brown fine sand and medium sand; loose.

Two Waukegan soil types were mapped in Iowa County. Waukegan silt loam occurs on uplands and consists of silty material that is underlain by leached fine sand and medium sand at a depth of 24 to 45 inches. Waukegan loam has a loam or, in places, a gritty silt loam surface layer and is underlain by coarse material at a depth of 20 to 40 inches. These soils absorb water at a moderately rapid or rapid rate. The sloping or strongly sloping Waukegan soils are underlain by sand at a depth of 20 to 30 inches and, consequently, are droughty even in years of normal rainfall. The Waukegan soils are strongly acid or medium acid unless limed. They are low or medium in available nitrogen and low or very low in phosphorus and potassium. Yields of row crops ordinarily are average or above average but depend largely on the amount of rainfall and on management.

Waukegan loam, 0 to 2 percent slopes (WnA).—This

Waukegan loam, 5 to 9 percent slopes (WnC).—This soil occurs on convex slopes on uplands near the Iowa River. It has an 8- to 12-inch surface layer of very dark brown to very dark grayish-brown loam to gritty silt loam. Included in the areas mapped are small areas that slope as much as 15 percent. Also included are a few Waukegan soils that have a 3- to 6-inch surface layer, and some soils that have an indistinct, light-colored subsurface layer.

This soil warms up quickly in spring and is easy to work, but it tends to be moderately droughty. Moisture stresses commonly occur in midsummer. If row crops are grown, this soil needs to be tilled on the contour, stripcropped on the contour, or terraced. It can be used more frequently for row crops if fields are terraced. Although terraces are easily constructed, cuts should be held to a minimum to avoid exposing the sandy substratum. Yields of corn vary but are often moderate, provided management is good and rainfall is well distributed throughout the growing season. Additions of organic matter are beneficial. *Capability unit IIIs–2.*

Waukegan silt loam, 2 to 5 percent slopes (WsB).—This silty soil is underlain by leached medium and fine sand at a depth of 24 to 45 inches. It occurs mainly as a narrow band, about 1 mile wide, along U.S. Highway 6. This band extends from the junction of State Highway 149 eastward to the county line. A few areas also occur near Price Creek in Lenox Township. Most slopes are long and smooth.

This soil warms up early in spring and is easy to work, but it is readily eroded by runoff and is slightly droughty. If used for row crops it needs to be tilled on the contour, stripcropped on the contour, or terraced. The long, smooth slopes are well suited to terracing, but cuts should

Wiota Series

The Wiota series consists of well drained or moderately well drained, dark-colored soils that formed from silty

The Zook soils have a slow or very slow rate of water intake and often are ponded for several days after rains. The water table generally is high. If artificially drained, these soils are well suited to row crops. They are slightly soil to a depth of 4 to 6 feet is significant. In many of the soils of Iowa County, the surface layer is similar, but the lower layers differ greatly. This difference commonly determines whether a soil is well suited or poorly suited to crops. For example, the Kenyon and Adair soils both have a loamy surface layer but differ greatly in the production of crops because of the difference in their lower layers. The Kenyon soils have a loamy subsoil that is permeable to water, roots, and air. By contrast, the Adair soils have a subsoil of tough, dense, heavy, reddish-brown clay that is difficult for roots and water to penetrate. Consequently, the Adair soils stay wet and soggy in spring. Plants on the Adair soils often turn yellow from lack of air and nitrogen.

Following are some soil properties that are most significant in soil management.

Color and thickness of the surface layer.—Soils that have a thick, dark-colored surface layer are considered most desirable by farmers, provided the subsoil is also suitable. The surface layer generally is thick and dark colored in soils formed under tall prairie grasses and thin

slopes are cultivated, management practices are needed to reduce the loss of soil and water, to maintain fertility, and to prevent the formation of gullies. Runoff can be largely controlled by tilling on the contour, stripcropping, terracing, and the use of diversions. Modern machinery generally is best suited to level and gently sloping areas but is moderately well suited to uniform slopes of as much as 10 percent, provided these areas are not gullied. Special management is needed to restore productivity to severely eroded soils.

Basic Practices of Management

Farmers should select management practices that are suited to their soils. This subsection discusses some of the basic practices of management that are used in Iowa County. More specific suggestions for groups of soils are given in the subsection "Management by Capability Units," and some suggestions for individual soils are given in the section "Descriptions of the Soils."

Liming and Fertilizing.—Most soils in Iowa County under mixed vegetation of forest and grass. Therefore, phosphorus distribution in the subsoil is intermediate between that of soils developed under grass and soils developed under forest. Available phosphorus in soils on bottom lands varies considerably but generally is low or medium below the plow layer.

Soils in Iowa County generally need lime if legumes are grown, unless they have been limed within the previous 5 years. An exception is the Hopper soils, which have a sufficient amount of lime in the surface layer and an excess amount in the subsoil.

The optimum rate of application of nitrogen for corn varies from 0 to 40 pounds per acre if corn follows meadow to as much as 80 to 120 pounds per acre if corn has been grown for 4 years or more. However, the optimum rate also depends to some extent on (1) the quality of the preceding legume meadow and number of years of legume meadow; (2) the amount of manure applied; (3) the stand level (an additional 10 to 15 pounds of nitrogen is

requirements of corn generally exceed the amount of rainfall. In turn, increased corn residues from heavier stands of corn help to conserve both soil and water.

Erosion commonly increases the need for all soil nutrients and increases the cost of crop production over the years. Soil tests indicate that nitrogen, phosphorus, and potassium levels normally are higher in the surface layer than in the underlying layer. Thus, rapid erosion of the surface layer will result in the nutrient-deficient subsurface layer becoming the plow layer.

Terracing is widely needed throughout the county to help reduce soil losses. Corn can be grown more frequently in the rotation if fields are terraced than if other conservation practices are used. Soils that have a slope of more than 12 percent are not well suited to terracing, and fine-textured soils, such as the Adair and Keswick, are poorly suited. Terraces are difficult to construct and to maintain on sandy soils.

All erosion control practices should be planned to fit the needs of an individual farm. A representative of the

In this system all the kinds of soil are grouped at three levels, the capability class, subclass, and unit. The eight capability classes in the broadest grouping are designated by Roman numerals I through VIII. In class I are the

are cultivated and not protected.

Subclass IIIw. Soils that have severe limitations because of excess water.

Subclass IIIs. Soils that have severe limitations of in spring, runoff from higher areas collects in places but generally does not stand on the surface for long periods.

These soils are easy to till and are readily penetrated by roots to a depth of several feet. They are among the most productive soils in the county. All of the soils are high in moisture-holding capacity except the Waukegan soil, which is moderate. Drainage generally is adequate, but in wet years tile drains are beneficial in some places. Erosion is not a hazard.

The soils in this unit are well suited to cultivated crops. The use of liberal amounts of fertilizer helps to maintain

Waukegan, Waubeek, and Wiota soils. These soils are dark colored or moderately dark colored and are well drained or moderately well drained. They have a friable, medium-textured surface layer and a friable to firm, medium-textured or moderately fine textured subsoil. Runoff is sufficient to cause soil erosion.

The soils in this unit are medium or high in organic-matter content. They absorb much of the rain that falls, but some runoff occurs because of the slope. Permeability is moderately slow in the Ladoga and Otley soils but moderate in the other soils. The moisture-holding capacity creeks and large streams. They occur where water concentrates and thus are subject to gullying. Siltation is also a hazard if heavy rains occur when crops are small and adjoining higher soils are not protected from erosion.

Permanent grassed waterways are needed on these soils. Diversions will help to control runoff from nearby slopes and to prevent siltation. Because the movement of air and water is somewhat restricted, these soils tend to dry out slowly in spring. They are benefited by tile drainage if the lines are properly installed. In places erosion control structures are needed in addition to grassed waterways to prevent the formation of gullies at tile outlets.

The soils in this unit are highly productive but generally are farmed with adjoining soils. Areas that are suitable for farming can be used intensively for corn, soybeans, and other row crops.

CAPABILITY UNIT IIw–2

In this unit are poorly drained or somewhat poorly drained, dark colored and moderately dark colored soils of the Bremer, Colo, Nodaway, and Zook series. All of these soils have a moderately fine textured surface layer except the Nodaway, which has a medium-textured surface layer. The soils in this unit occur on first and second bot-

in spring but recedes during the growing season. Thus, fall plowing often insures earlier planting in spring. Erosion is not a hazard.

If liberal amounts of commercial fertilizer are applied, this soil can be used intensively for corn and soybeans. Lime generally is needed for best yields.

CAPABILITY UNIT IIw–4

This unit consists of somewhat poorly drained, light-colored to moderately dark colored Jackson, Keomah, and Stronghurst soils on nearly level uplands and terraces. These soils have a friable, medium-textured surface layer and a medium-textured or moderately fine textured subsoil. They are low in organic-matter content and are high in water-holding capacity. They may be wet for short periods during the early part of the growing season because of a seasonal high water table.

These soils warm up a little more slowly in spring than the dark-colored soils. Although they are moderately well suited to row crops, green-manure crops and crop residues are needed to maintain good tilth if row crops are grown frequently. A meadow crop is more important on these soils than on the darker colored soils. Field operations generally can be undertaken earlier in spring if these

CAPABILITY UNIT IIIe-1

This unit consists of deep, dark colored and moderately dark colored soils of the Bassett, Downs, Dinsdale, Gara, Kenyon, Ladoga, Otley, Shelby, Tama, and Waubeek series. These soils have a friable, medium-textured surface layer and a friable, moderately fertile, medium-textured or moderately fine textured subsoil. The slope ranges from 5 to 9 percent. Some of these soils are moderately eroded, and some spots are severely eroded. All of the soils are well aerated and, except in the severely eroded spots, have good tilth. They are easy to cultivate, even though the organic-matter content ranges from very low to high. The rate of water intake normally is good, but some runoff occurs because of the slope. The moisture-holding capacity is high. The soils of this unit make up

if management is good. Adequate amounts of fertilizer are needed for the best yields of both crops and pasture. Lime generally is needed, particularly if legumes are grown. Crop residues, left on the surface, help to control erosion by improving the rate of water intake and by reducing runoff.

CAPABILITY UNIT IIIe-3

This unit consists of dark colored and moderately dark colored soils of the Bassett, Downs, Gara, Kenyon, Ladoga, Otley, Shelby, and Tama series. These soils have a friable, medium-textured surface layer and a medium-textured or moderately fine textured subsoil. The subsoil is moderately fertile and is moderately permeable or moderately slowly permeable. The slope ranges from 9 to 14

CAPABILITY UNIT IIIe-5

This unit consists only of the moderately sloping, slowly permeable Adair soil. This soil has a friable, medium-textured surface layer but a firm clayey subsoil that retards the downward movement of water. It is moderately well drained but is seasonally wet because of seepage from more permeable soils upslope. Runoff is fairly rapid, and erosion is difficult to control.

This soil commonly occurs in narrow bands and is closely associated with the Otley soils upslope and with the Shelby soils downslope. In most places the rotation is determined by the associated soils, which make up the larger part of the landscape. If this soil is used for row crops, tillage should be done on the contour. Terracing generally is not satisfactory because of the heavy, compact subsoil. The response to fertilizer is poor, and yields normally are low. Most areas can be left in meadow an extra year or more when the surrounding soils are cultivated.

The Adair soil puddles readily and becomes compact if plowed when wet. In spring it is not uncommon for tractors to become mired in these wet areas. Interceptor tile is needed in places to drain seepy areas.

CAPABILITY UNIT IIIw-1

This unit is made up of the very poorly drained, dark-colored Wabash soil. This soil occurs in low, slightly

as soon as surrounding soils. Tile functions fairly well, but in places surface drains are needed to remove ponded water.

The soils of this unit occur in small areas and in wet years can be left idle when surrounding soils are cultivated. Although corn and soybeans are the principal crops, the rotation generally is the same as that of surrounding soils. Alfalfa and similar legumes are frequently drowned or winterkilled. The response to fertilizer varies, but in years of average or less than average rainfall, the response is good. Additions of potash are beneficial in most areas because aeration is poor. Yields vary according to the wetness of the soils.

CAPABILITY UNIT IIIs-1

In this unit are moderately sloping, well-drained to excessively drained soils of the Chelsea, Dickinson, Fayette, Hagener, Lamont, and Tama series. These soils have a friable, medium-textured to coarse-textured surface layer. The subsoil is medium textured or moderately fine textured in the Fayette and Tama soils, moderately coarse textured in the Dickinson and Lamont soils, and coarse textured in the Hagener and Chelsea soils. The Chelsea, Dickinson, and Hagener soils have low moisture-holding capacity and are rapidly permeable. Surface runoff is slow on all of the soils in this unit except the Tama and

These soils are droughty and are susceptible to erosion. They are moderately well suited to cultivated crops and are used mainly for row crops, hay, and pasture. Root growth is restricted to some extent by the underlying sand. To reduce soil and water losses, many areas can be terraced, but cuts need to be kept to a minimum so as not to expose the coarse-textured substratum. If fields are terraced, corn can be grown for 3 years in 5 on the Waukegan soils, and for 2 years in 5 on the Tell soils. Yields are favorable in years of normal rainfall or when rainfall is evenly distributed throughout the growing season. Nevertheless, yields may vary from one area to another because of the variation in depth to the sandy material. If rainfall is adequate, the response to fertilizer is good. During periods of low rainfall, crops respond to irrigation, but large amounts of fertilizer are needed to make irrigation profitable.

CAPABILITY UNIT IIIs-3

This unit consists of nearly level and gently sloping,

corn is grown. A rotation that includes corn only once in 5 years can be used, but as a rule row crops should be grown only when hay and pasture need reseeding. Soybeans are not suitable. In places there are gullies that need to be shaped and seeded. In some areas diversion terraces, placed at the base of slopes, will help to protect soils downslope from runoff. Lime and phosphate generally are required to establish legumes and grass.

CAPABILITY UNIT IVe-2

This unit consists of deep, moderately steep, light-colored Clinton, Fayette, and Hopper soils on uplands. These soils differ from the soils in unit IVe-1 in that they are lighter colored and are lower in organic-matter content. The surface layer is friable silt loam. The subsoil is moderately fine textured in the Clinton and Fayette soils and medium textured in the Hopper soil. The movement of air and water through the soils is good, and the water-holding capacity is high. Because of their somewhat poorly granulated surface layer and moderately steep slopes, these soils are susceptible to severe erosion. The

CAPABILITY UNIT IVe-4

This unit consists of severely eroded, strongly sloping, light-colored to dark-colored soils of the Bassett, Clinton, Downs, Fayette, Gara, Ladoga, Otley, Shelby, and Tama series. These soils have a friable, medium-textured or moderately fine textured surface layer and a moderately

CAPABILITY UNIT IVs-1

This unit consists of deep, excessively drained, nearly level or moderately sloping Chelsea and Hagener soils. These soils have a loose or very friable, moderately coarse textured or coarse textured surface layer and subsoil and are shallow over coarse textured material. They warm up tured surface layer and subsoil. Permeability is moderate or moderately slow, the water-holding capacity is high, and the organic-matter content is low. The surface may seal during hard rains. Consequently, runoff generally is high, and the hazard of further erosion is serious. Small rocks, large enough to interfere with tillage, occur in places on the surface of the Gara, Bassett, and Shelby soils. Because of poor workability and tilth, the soils of this unit are often referred to locally as the "clay soils."

Although most of the acreage has been used for culti-

series. These soils have a medium-textured or moderately fine textured surface layer and a firm clayey subsoil that is slowly permeable or moderately slowly permeable. Although all of the soils are moderately well drained, the Adair and Keswick soils are seasonally wet because of seepage from more permeable soils upslope. Runoff is rapid, and soil losses are high in cultivated fields. In places there are deep waterways and gullies that interfere with the use of farm machinery. Small stones occur on the surface in some places. The range of moisture conficult to prepare. In places there are deep gullies and waterways that interfere with the use of farm machinery. Small stones occur on the surface in some areas.

These soils can be used for pasture or trees. In places the Adair soils occur as narrow bands and are closely associated with more productive soils. These areas are best left in permanent vegetation when the adjoining soils are cultivated. They make good habitats for wildlife. Yields of forage crops are low on the soils in this unit, and grazing needs to be controlled to insure a permanent cover of vegetation. Although some areas can be planted to trees

CAPABILITY UNIT VIIs-1

This unit consists of light-colored and dark-colored, strongly sloping or steep Chelsea and Hagener soils. These soils are coarse textured and are extremely droughty and erodible. They are rapidly permeable and have low moisture-holding capacity. Fertility generally is low.

The soils of this unit have low value as permanent pasture. Most areas are small and generally are left idle or are farmed with adjoining soils. A few areas are wooded, but most of these areas need improvement. The renovation of pastures is difficult on these soils because slopes are

TABLE 2.—*Management*

[Dashed line indicates that the crop is not

Map symbol	Soil	Capability unit	Management problems
AaC2	Adair clay loam, 5 to 9 percent slopes, moderately eroded	IIIe-5	Sheet erosion; seepy, tight subsoil; poor tilth.
AaD2	Adair clay loam, 9 to 14 percent slopes, moderately eroded	IVe-3	Sheet erosion; seepy, tight subsoil; poor tilth.
AaE2	Adair clay loam, 14 to 18 percent slopes, moderately eroded	VIe-3	Sheet erosion; tight subsoil; poor tilth.
AcD2	Adair clay loam, thin solum, 9 to 14 percent slopes, moderately eroded.	IVe-3	Sheet erosion; poor tilth; low inherent fertility.
AcE2	Adair clay loam, thin solum, 14 to 18 percent slopes, moderately eroded.	VIe-3	Sheet erosion; poor tilth; low inherent fertility.
AdD3	Adair soils, 9 to 14 percent slopes, severely eroded	VIe-3	Sheet erosion; seepy, tight subsoil; poor tilth.
AdE3	Adair soils, 14 to 18 percent slopes, severely eroded	VIIe-1	Sheet erosion; tight subsoil; poor tilth.
AeD3	Adair soils, thin solum, 9 to 14 percent slopes, severely eroded.	VIe-3	Sheet erosion; poor tilth; low inherent fertility.
AeE3	Adair soils, thin solum, 14 to 18 percent slopes, severely	VIIe-1	Sheet erosion; poor tilth; low inherent

and yield data for soils

suited to the soil or is not generally grown on it]

Crop rotations and other uses	Conservation practices	Expected yields per acre under high-level management

TABLE 2.—*Management*

Map symbol	Soil	Capability unit	Management problems
BrB	Bertrand silt loam, 2 to 5 percent slopes	IIe-2	Sheet erosion.
BrC2	Bertrand silt loam, 5 to 9 percent slopes, moderately eroded	IIIe-2	Sheet erosion.
Bs	Bremer silty clay loam	IIw-2	Moderate wetness.
Bt	Bremer silt loam, overwash	IIw-2	Wetness; siltation.
Ca	Chariton silt loam	IIIw-2	Wetness; ponding water.
CeB	Chelsea fine sand, 2 to 9 percent slopes	IVs-1	Severe droughtiness; wind and water erosion.
CeD	Chelsea fine sand, 9 to 18 percent slopes	VIIs-1	Severe droughtiness; wind and gully erosion.
CeG	Chelsea fine sand, 18 to 40 percent slopes	VIIs-1	Severe droughtiness; wind and gully erosion.
CfC	Chelsea-Fayette-Lamont complex, 5 to 9 percent slopes	IIIs-1	Moderate droughtiness; sheet and gully erosion.
CfD	Chelsea-Fayette-Lamont complex, 9 to 14 percent slopes	IVe-5	Moderate droughtiness; sheet and gully erosion.
CfD2	Chelsea-Fayette-Lamont complex, 9 to 14 percent slopes, moderately eroded.	IVe-5	Moderate droughtiness; sheet and gully erosion.
CfE	Chelsea-Fayette-Lamont complex, 14 to 18 percent slopes	VIe-2	Sheet erosion; moderate droughtiness.
CfE2	Chelsea-Fayette-Lamont complex, 14 to 18 percent slopes, moderately eroded.	VIe-2	Sheet erosion; moderate droughtiness.
CfG	Chelsea-Fayette-Lamont complex, 18 to 40 percent slopes	VIIe-3	Sheet erosion; moderate droughtiness.
ClB	Clinton silt loam, 2 to 5 percent slopes	IIe-2	Sheet erosion.
ClC	Clinton silt loam, 5 to 9 percent slopes	IIIe-2	Sheet erosion.
ClC2	Clinton silt loam, 5 to 9 percent slopes, moderately eroded	IIIe-2	Sheet erosion.
ClD	Clinton silt loam, 9 to 14 percent slopes	IIIe-4	Sheet erosion.
ClD2	Clinton silt loam, 9 to 14 percent slopes, moderately eroded	IIIe-4	Sheet erosion.
ClE2	Clinton silt loam, 14 to 18 percent slopes, moderately eroded	IVe-2	Sheet erosion.

See footnotes at end of table.

and yield data for soils—Continued

Crop rotations and other uses	Conservation practices for cultivated crops	Expected yields per acre under high-level management				
		Corn	Soybeans	Oats	Hay	Pasture
		Bu.	*Bu.*	*Bu.*	*Tons*	*Animal-unit-days* [1]
R–R–O–M–M	None	85	30	64	3. 4	170
R–R–R–O–M or R–R–R–Ox [3]	Terracing	85	30	64	3. 4	170
R–R–R–O–M	Contouring	85	30	64	3. 4	170
R–O–M–M–M	None	80	25	60	3. 2	160
R–R–R–O–M	Terracing	80	25	60	3. 2	160
R–R–O–M–M–M	Contouring	80	25	60	3. 2	160
R–R–O–M–M or R–R–O–M–M–M	Stripcropping	80	25	60	3. 2	160
Intensive row cropping	None	85	40	65	3. 4	170
Intensive row cropping	None	80	32	60	3. 0	150
Intensive row cropping	None	[7] 70	[7] 25	[7] 45	[7] 2. 0	[7] 100
R–O–M–M	None	45	15	33	1. 8	90
R–O–M–M	Contouring	45	15	33	1. 8	90
R–O–M–M	Stripcropping	45	15	33	1. 8	90
Permanent pasture [4]	(5)				1. 2	60
Permanent pasture [4]	(5)				. 5	25
R–O–M–M–M	None	45	15	33	1. 8	90
R–R–O–M–M–M	Contouring	45	15	33	1. 8	90
R–R–O–M–M or R–R–O–M–M–M	Stripcropping	45	15	33	1. 8	90
Long-term meadow	None				1. 6	80
Long-term meadow	Contouring				1. 6	80
R–O–M–M	Stripcropping	40		30	1. 6	80
Long-term meadow	None				1. 4	70
Long-term meadow	Contouring				1. 4	70
R–O–M–M	Stripcropping	38		28	1. 4	70

TABLE 2.—*Management*

Map symbol	Soil	Capability unit	Management problems
ClF2	Clinton silt loam, 18 to 25 percent slopes, moderately eroded	VIe-2	Sheet erosion.
CnD3	Clinton soils, 9 to 14 percent slopes, severely eroded	IVe-4	Sheet erosion; poor tilth; low fertility.
CnE3	Clinton soils, 14 to 18 percent slopes, severely eroded	VIe-1	Sheet erosion; poor tilth; low fertility.
Co	Colo silty clay loam	IIw-2	Wetness; occasional flooding.
Cs	Colo silt loam, overwash	IIw-2	Wetness; moderate flooding.
Ct	Colo-Ely complex, 1 to 5 percent slopes	IIw-1	Wetness; local flooding; gullies.
Cu	Coppock silt loam	IIw-1	Wetness; local flooding.
DcA	Dickinson sandy loam, 0 to 2 percent slopes	IIIs-3	Droughtiness; wind erosion.
DcB	Dickinson sandy loam, 2 to 5 percent slopes	IIIs-3	Droughtiness; wind and water erosion.
DcC	Dickinson sandy loam, 5 to 9 percent slopes	IIIs-1	Droughtiness; sheet erosion.
DbB	Dinsdale silty clay loam, 2 to 5 percent slopes	IIe-1	Sheet erosion.
DdC	Dinsdale silty clay loam, 5 to 9 percent slopes	IIIe-1	Sheet erosion.
DoB	Downs silt loam, 2 to 5 percent slopes	IIe-1	Sheet erosion.
DoC	Downs silt loam, 5 to 9 percent slopes	IIIe-1	Sheet erosion.
DoC2	Downs silt loam, 5 to 9 percent slopes, moderately eroded	IIIe-1	Sheet erosion.

...nd yield data for soils—Continued

TABLE 2.—*Management*

Map symbol	Soil	Capability unit	Management problems
EsB	Ely silt loam, 2 to 5 percent slopes	IIw-1	Slight wetness; sheet erosion.
FaB	Fayette silt loam, 2 to 5 percent slopes	IIe-2	Sheet erosion.
FaC	Fayette silt loam, 5 to 9 percent slopes	IIIe-2	Sheet erosion.
FaC2	Fayette silt loam, 5 to 9 percent slopes, moderately eroded	IIIe-2	Sheet erosion.
FaD	Fayette silt loam, 9 to 14 percent slopes	IIIe-4	Sheet erosion.
FaD2	Fayette silt loam, 9 to 14 percent slopes, moderately eroded	IIIe-4	Sheet erosion.
FaE	Fayette silt loam, 14 to 18 percent slopes	IVe-2	Sheet erosion.
FaE2	Fayette silt loam, 14 to 18 percent slopes, moderately eroded	IVe-2	Sheet erosion.
FaF	Fayette silt loam, 18 to 25 percent slopes	VIe-2	Sheet erosion.
FaF2	Fayette silt loam, 18 to 25 percent slopes, moderately eroded	VIe-2	Sheet erosion.
FaG	Fayette silt loam, 25 to 40 percent slopes	VIIe-3	Sheet erosion.
FbB	Fayette silt loam, benches, 2 to 5 percent slopes	IIe-2	Sheet erosion.
FsD3	Fayette soils, 9 to 14 percent slopes, severely eroded	IVe-4	Sheet erosion; poor tilth; low fertility.
FsE3	Fayette soils, 14 to 18 percent slopes, severely eroded	VIe-1	Sheet erosion; poor tilth; low fertility.
FsF3	Fayette soils, 18 to 25 percent slopes, severely eroded	VIe-2	Sheet erosion; poor tilth; low fertility.
GaC2	Gara loam, 5 to 9 percent slopes, moderately eroded	IIIe-1	Sheet erosion.
GaD2	Gara loam, 9 to 14 percent slopes, moderately eroded	IIIe-3	Sheet erosion.
GaE2	Gara loam, 14 to 18 percent slopes, moderately eroded	IVe-1	Sheet and gully erosion.

See footnotes at end of table.

and yield data for soils—Continued

Crop rotations and other uses	Conservation practices for cultivated crops	Expected yields per acre under high-level management				
		Corn	Soybeans	Oats	Hay	Pasture
		Bu.	*Bu.*	*Bu.*	*Tons*	*Animal-unit-days* [1]
R–R–O–M	None	92	35	70	3. 7	185
Intensive row cropping	Terracing	92	35	70	3. 7	185
R–R–O–M or R–R–R–Ox	Contouring	92	35	70	3. 7	185

TABLE 2.—*Management*

Map symbol	Soil	Capability unit	Management problems
GaF2	Gara loam, 18 to 25 percent slopes, moderately eroded	VIe-2	Sheet and gully erosion.
GrD3	Gara soils, 9 to 14 percent slopes, severely eroded	IVe-4	Sheet erosion; poor tilth; low fertility.
GrE3	Gara soils, 14 to 18 percent slopes, severely eroded	VIe-1	Sheet and gully erosion; poor tilth; low fertility.
GrF3	Gara soils, 18 to 25 percent slopes, severely eroded	VIIe-1	Sheet erosion; poor tilth; low fertility.
Gs	Givin silt loam	I-1	Slight wetness.
Gu	Gullied land	VIIe-2	Severe gully erosion; very low fertility.
HaA	Hagener fine sand, 0 to 2 percent slopes	IVs-1	Droughtiness; slight wind erosion.
HaB	Hagener fine sand, 2 to 5 percent slopes	IVs-1	Droughtiness; slight wind and water erosion.
HaC	Hagener fine sand, 5 to 9 percent slopes	IVs-1	Severe droughtiness; slight wind and sheet erosion.
HaD	Hagener fine sand, 9 to 14 percent slopes	VIs-1	Severe droughtiness; slight wind and sheet erosion.
HaE	Hagener fine sand, 14 to 25 percent slopes	VIIs-1	Severe droughtiness; slight wind and severe sheet erosion.
HgB	Hagener-Tama complex, 2 to 5 percent slopes	IIIs-3	Slight droughtiness; slight wind and sheet erosion.
HgC	Hagener-Tama complex, 5 to 9 percent slopes	IIIs-1	Slight droughtiness; sheet erosion.
HgC2	Hagener-Tama complex, 5 to 9 percent slopes, moderately eroded.	IIIs-1	Slight droughtiness; sheet erosion.
HgD2	Hagener-Tama complex, 9 to 14 percent slopes, moderately eroded.	IVe-5	Slight droughtiness; sheet erosion.
HgE2	Hagener-Tama complex, 14 to 18 percent slopes, moderately eroded.	VIe-2	Slight droughtiness; sheet erosion.
HoD2	Hopper silt loam, 9 to 14 percent slopes, moderately eroded	IIIe-4	Sheet erosion.
HoE2	Hopper silt loam, 14 to 18 percent slopes, moderately eroded	IVe-2	Sheet erosion.
HoE3	Hopper silt loam, 14 to 18 percent slopes, severely eroded	VIe-1	Sheet erosion; low fertility.
HoF2	Hopper silt loam, 18 to 25 percent slopes, moderately eroded	VIe-2	Sheet erosion.
Ja	Jackson silt loam	IIw-4	Slight wetness; fertility maintenance.

See footnotes at end of table.

and yield data for soils—Continued

Crop rotations and other uses	Conservation practices for cultivated crops	Expected yields per acre under high-level management				
		Corn	Soybeans	Oats	Hay	Pasture
		Bu.	*Bu.*	*Bu.*	*Tons*	*Animal-unit-days* [1]
Permanent pasture [4]	([5])				1. 2	60
Long-term meadow	None				2. 2	110
Long-term meadow	Contouring				2. 2	110
R–O–M–M–M	Stripcropping	55		40	2. 2	110
Permanent pasture [4]	([5])				1. 6	80
Permanent pasture [4]	([5])				. 8	40
Intensive row cropping	None	85	35	64	3. 4	170
Permanent pasture [4]	([5])				. 5	25
R–R–O–M	None	55	22	40	2. 1	105
R–O–M	None	50	20	37	2. 0	100
R–R–O–M	Contouring	50	20	37	2. 0	100
R–O–M–M	None	45	18	33	1. 8	90
R–O–M	Contouring	45	18	33	1. 8	90

TABLE 2.—*Management*

Map symbol	Soil	Capability unit	Management problems
JuB	Judson silt loam, 2 to 6 percent slopes	IIe-1	Sheet erosion; overflow from adjoining uplands.
KnB	Kenyon loam, 2 to 5 percent slopes	IIe-1	Sheet erosion.
KnC	Kenyon loam, 5 to 9 percent slopes	IIIe-1	Sheet erosion.
KnC2	Kenyon loam, 5 to 9 percent slopes, moderately eroded	IIIe-1	Sheet erosion.
KnD2	Kenyon loam, 9 to 14 percent slopes, moderately eroded	IIIe-3	Sheet erosion.
Ko	Keomah silt loam	IIw-4	Slight wetness; fertility maintenance.

and yield data for soils—Continued

TABLE 2.—*Management*

Map symbol	Soil	Capability unit	Management problems
LaE2	Ladoga silt loam, 14 to 18 percent slopes, moderately eroded	IVe-1	Sheet erosion.
LbB	Ladoga silt loam, benches, 2 to 5 percent slopes	IIe-1	Sheet erosion.
LdD3	Ladoga soils, 9 to 14 percent slopes, severely eroded	IVe-4	Sheet erosion; low fertility; poor tilth.
LdE3	Ladoga soils, 14 to 18 percent slopes, severely eroded	VIe-1	Sheet erosion; low fertility; poor tilth.
Le	Lawler loam	I-1	Slight wetness.
[illegible]	Lawson silt loam	I-2	Slight wetness; occasional flooding.

and yield data for soils—Continued

		Expected yields per acre under high-level management
[illegible]	[illegible]	[illegible]

TABLE 2.—*Management*

Map symbol	Soil	Capability unit	Management problems
OcD2	Otley silty clay loam, 9 to 14 percent slopes, moderately eroded.	IIIe-3	Sheet erosion.
OcD3	Otley silty clay loam, 9 to 14 percent slopes, severely eroded.	IVe-4	Sheet erosion; poor tilth.
OcE2	Otley silty clay loam, 14 to 18 percent slopes, moderately eroded.	IVe-1	Sheet erosion.
OtB	Otley silty clay loam, benches, 2 to 5 percent slopes	IIe-1	Sheet erosion.
ShC	Shelby loam, 5 to 9 percent slopes	IIIe-1	Sheet erosion.

and yield data for soils—Continued

Crop rotations and other uses	Conservation practices for cultivated crops	Expected yields per acre under high-level management				
		Corn	Soybeans	Oats	Hay	Pasture
		Bu.	*Bu.*	*Bu.*	*Tons*	*Animal-unit-days* [1]
Long-term meadow	None				3. 2	160
R–O–M–M	Terracing	80		60	3. 2	160
R–O–M–M–M	Contouring	80		60	3. 2	160
R–R–O–M–M–M or R–O–M–M	Stripcropping	80		60	3. 2	160
Long-term meadow	None				3. 0	150
R–O–M–M	Terracing	72		55	3. 0	150
R–O–M–M–M	Contouring	72		55	3. 0	150
R–O–M–M	Stripcropping	72		55	3. 0	150
Long-term meadow	None				2. 8	140
Long-term meadow	Contouring				2. 8	140
R–O–M–M–M	Stripcropping	70		52	2. 8	140
R–R–O–M–M	None	95	35	72	3. 8	190
Intensive row cropping	Terracing	95	35	72	3. 8	190
R–R–R–O–M	Contouring	95	35	72	3. 8	190
R–O–M–M	None	75	25	55	3. 0	150
R–R–O–M	Terracing	75	25	55	3. 0	150
R–R–O–M–M–M	Contouring	75	25	55	3. 0	150

TABLE 2.—*Management*

Map symbol	Soil	Capability unit	Management problems
TcD3	Tama silty clay loam, 9 to 14 percent slopes, severely eroded	IVe-4	Sheet erosion; low fertility; poor tilth.
TcE2	Tama silty clay loam, 14 to 18 percent slopes, moderately eroded.	IVe-1	Sheet erosion.
[illegible]	[illegible] percent slopes	I-1	Fertility maintenance.

and yield data for soils—Continued

TABLE 2.—*Management*

Map symbol	Soil	Capability unit	Management problems
WsC	Waukegan silt loam, 5 to 9 percent slopes	IIIs-2	Sheet erosion; moderate droughtiness.
WtA	Wiota silt loam, 0 to 2 percent slopes	I-1	Fertility maintenance.
WtB	Wiota silt loam, 2 to 5 percent slopes	IIe-1	Sheet erosion.
Zk	Zook silty clay loam	IIw-2	Severe wetness; some flooding; slow drain-

and yield data for soils—Continued

Crop rotations and other uses	Conservation practices for cultivated crops	Expected yields per acre under high-level management				
		Corn	Soybeans	Oats	Hay	Pasture
		Bu.	*Bu.*	*Bu.*	*Tons*	*Animal-unit-days* [1]
R-O-M-M	None	73	23	52	2. 8	140
R-R-R-O-M	Terracing	73	23	52	2. 8	140
R-R-O-M-M	Contouring	73	23	52	2. 8	140
R-R-O-M-M	Stripcropping	73	23	52	2. 8	140
Intensive row cropping	None	105	40	75	4. 0	200
R-R-O-M	None	95	35	72	3. 8	190
Intensive row cropping	Terracing	95	35	72	3. 8	190

Suitability of trees for various uses

Trees suitable for planting as windbreaks around farmsteads or as protection from drifting snow are eastern white pine, eastern redcedar, Scotch pine, red pine, and Norway spruce. To make the windbreak more effective, one or two rows of honeysuckle or other such plant can be grown around the outside of the windbreak.

Trees suitable for planting in, across, or around crop fields to help control wind erosion are hybrid poplars (cottonwood), eastern redcedar, eastern white pine, Scotch pine, and red pine. In places trees are planted across the

Woodland suitability groups

Management of woodland can be planned more effectively if soils are grouped according to those characteristics that affect the growth of trees and the management of the stands. For this reason, the soils of Iowa County have been placed in nine woodland suitability groups. Each group consists of soils that have about the same suitability for wood crops, require about the same management, and have about the same potential productivity.

In each group, trees most suitable for forest, windbreaks, or Christmas trees are listed. Also listed are the trees and shrubs most suitable for wildlife cover. These include some species that provide food as well as cover.

TABLE 3.—*Soil ratings for tree planting and woodland production*—Continued

Soil series and mapping symbol	Aspect	Woodland suitability group	Site index for upland oaks	Hardwood production in board feet per acre per year [1]
Colo:				
Co, Cs	All aspects	9	(2)	(3)
Colo-Ely complex:				
Ct	All aspects	9	(2)	(3)
Coppock:				
Cu	All aspects	7	(2)	(3)
Dickinson:				
DcA, DcB, DcC	All aspects	1	(2)	(3)
Dinsdale:				
DdB, DdC	All aspects	4	(2)	(3)
Downs:				
DoB, DoC, DoC2, DoD2, DpB, DsD3	All aspects	4	52	135
DoE2, DsE3	North and east slopes	4	52	135
DoE2, DsE3	South and west slopes	5	52	135
Ely:				
EsB	All aspects	4	(2)	(3)
Fayette:				
FaB, FaC, FaC2, FaD, FaD2, FbB, FsD3	All aspects	4	68 (54–74)	250
FaE, FaE2, FaF, FaF2, FaG, FsE3, FsF3	North and east slopes	4	68 (54–74)	250
FaE, FaE2, FaF, FaF2, FaG, FsE3, FsF3	South and west slopes	5	68 (54–74)	250
Gara:				
GaC2, GaD2, GrD3	All aspects	4	57	160
GaE2, GaF2, GrE3, GrF3	North and east slopes	4	57	160
GaE2, GaF2, GrE3, GrF3	South and west slopes	5	57	160
Givin:				
Gs	All aspects	4	70 [4]	260
Gullied land:				
Gu	North and east slopes	4	50 [4]	125
Gu	South and west slopes	5	50 [4]	125
Hagener:				
HaA, HaB, HaC, HaD	All aspects	1	(2)	(3)
HaE	North and east slopes	1	(2)	(3)
HaE	South and west slopes	2	(2)	(3)
Hagener-Tama complex:				
HgB, HgC, HgC2, HgD2	All aspects	1	(2)	(3)
HgE2	North and east slopes	1	(2)	(3)
HgE2	South and west slopes	2	(2)	(3)
Hopper:				
HoD2	All aspects [7]	4	45 [4]	80
HoE2, HoE3, HoF2	North and east slopes [7]	4	45 [4]	80
HoE2, HoE3, HoF2	South and west slopes [7]	5	45 [4]	80
Jackson:				
Ja	All aspects	4	60 [4]	190
Judson:				
JuB	All aspects	4	(2)	(3)
Kenyon:				
[illegible]	All aspects	4	(2)	(3)

TABLE 3.—*Soil ratings for tree planting and woodland production*—Continued

Soil series and mapping symbol	Aspect	Woodland suitability group	Site index for upland oaks	Hardwood production in board feet per acre per year [1]
Keswick:				
KsD2, KwD3	All aspects	7	55 [4]	150
KsE2, KsF2, KwE3, KwF3	North and east slopes	7	55 [4]	150
KsE2, KsF2, KwE3, KwF3	South and west slopes	8	55 [4]	150
Koszta:				
Kz	All aspects	4	(2)	(3)
Ladoga:				
LaB, LaC, LaC2, LaD, LaD2, LdD3, LbB	All aspects	4	64	210
LaE2, LdE3	North and east slopes	4	64	210
LaE2, LdE3	South and west slopes	5	64	210
Lawler:				
Le	All aspects	4	(2)	(3)
Lawson:				
Lh	All aspects	4	(2)	(3)
Lindley:				
LnD2	All aspects	4	55 [4]	150
LnE2, LnF, LnF2, LnG, LsD3, LsE3, LsF3	North and east slopes	4	55 [4]	150
LnE2, LnF, LnF2, LnG, LsD3, LsE3, LsF3	South and west slopes	5	55 [4]	150
Mahaska:				
Ma	All aspects	4	(2)	(3)
Muscatine:				
Mu	All aspects	4	(2)	(3)
Nevin:				
Nc	All aspects	4	(2)	(3)
Nodaway:				
Nd, Nh, Ns	All aspects	6	58 (51–64)	180
Nodaway-Ely complex:				
Nx	All aspects	6	(2)	(3)
Otley:				
OtB, OcB, OcC, OcC2, OcD2, OcD3	All aspects	4	(2)	(3)
OcE2	North and east slopes	4	(2)	(3)
OcE2	South and west slopes	5	(2)	(3)
Shelby:				
ShC, ShC2, ShD2, SoD3	All aspects	4	(2)	(3)
ShE2, ShF2, SoE3	North and east slopes	4	(2)	(3)
ShE2, ShF2, SoE3	South and west slopes	5	(2)	(3)
Sperry:				
Sp	All aspects	7	(2)	(3)
Stronghurst:				
Sr, St	All aspects	4	70 [4]	265
Taintor:				
Ta	All aspects	1	(2)	(3)
Tama:				
TcB, TcC, TcC2, TcD2, TcD3, ThA, ThB	All aspects	4	(2)	(3)
TcE2	North and east slopes	4	(2)	(3)
TcE2	South and west slopes	5	(2)	(3)
Tell:				
TmB, TmC, TmC2, TmD2	All aspects	4	50 [4]	125

See footnotes at end of table.

TABLE 3.—*Soil ratings for tree planting and woodland production*—Continued

Soil series and mapping symbol	Aspect	Woodland suitability group	Site index for upland oaks	Hardwood production in board feet per acre per year [1]
Udolpho:				
Ud	All aspects	4	([2])	([3])
Wabash:				
Wa	All aspects	9	([2])	([3])
Walford:				
Wb	All aspects	7	50 [4]	125
Watkins:				
WkA, WkB	All aspects	4	51 [4]	130
Waubeek:				
WmB, WmC2	All aspects	4	51 [4]	130
Waukegan:				
WnA, WnB, WnC, WsB, WsC	All aspects	4	([2])	([3])
Wiota:				
WtA, WtB	All aspects	4	([2])	([3])
Zook:				
Zk, Zo	All aspects	9	([2])	([3])

[5] Variable on bottom lands. Maximum production from cotton-

14 percent commonly have northern and eastern exposures. The soils of this group generally are considered good agricultural soils and are also favorable for wood crops.

The trees suitable for planting are—

Eastern white pine.	Black walnut.
Scotch pine.	Cottonwood.
Red pine.	Green ash.
Norway spruce.	White ash.
European larch.	Basswood.
Black cherry (without spiral grain).	Red oak.[3]
	White oak.[3]

The shrubs and trees suitable for wildlife cover are—

Nannyberry.	Asiatic trailing raspberry.

0 to 14 percent generally have all exposures. Those that slope more than 14 percent, generally have northern or western exposures.

The trees suitable for planting are—

Cottonwood.	Eastern redcedar.
Green ash.	Eastern white pine.[4]
Hackberry.	Norway spruce.[4]
Sycamore.	

The shrubs and trees suitable for wildlife cover are—

Redosier dogwood.	Wild plum.
Eastern redcedar.	

WOODLAND SUITABILITY GROUP 8

This group consists of soils that are similar to the soils can obtain a minimum number of soil samples for laboratory testing and can make adequate soil investigations at minimum cost.

This soil survey report contains information that can be used by engineers to—

1. Make studies of soil and land use that will aid in the selection and development of industrial, business, residential, and recreational sites.
2. Assist in planning and designing drainage and irrigation structures and in planning dams and other structures for water and soil conservation.
3. Make reconnaissance surveys of soil and ground conditions that will aid in selecting highway and airport locations and in planning more detailed soil surveys for the intended locations.

Available moisture capacity is the amount of water in a moist soil, at field capacity, that can be removed by plants. These ratings, expressed in inches of water per inch of soil depth, are of particular value to engineers engaged in irrigation.

Shrink-swell potential is a rating of the ability of soil material to change volume when subjected to changes in moisture. Those soil materials rated high are normally undesirable from the engineering standpoint, since the increase in volume when the dry soil is wetted is usually accompanied by a loss in bearing capacity. In general, soils classed as CH and A–7 have a high shrink-swell potential. Clean sands and gravels (single-grain structure) and soils having small amounts of nonplastic to slightly plastic fines have a low shrink-swell potential.

TABLE 4.—*Estimates of soil properties*

Soil series and map symbol	Depth from surface	Classification		
		USDA texture	Unified	AASHO
	Inches			
Adair, thin solum (AcD2, AcE2, AeD3, AeE3, AeF3).	0 to 6	Clay loam to loam	CL	A-6(8-12)
	6 to 49	Clay loam to clay	CL or CH	A-7-6(15-20)
	49 to 65	Loam to clay loam	CL	A-6(8-12)
Adair (AaC2, AaD2, AaE2, AdD3, AdE3).	0 to 8	Clay loam to loam	CL or CH	A-7-6(11-15)
	8 to 54	Clay to clay loam	CH	A-7-6(18-20)
	54 to 65	Clay loam	CL or CH	A-7-6(12-18)
Alluvial land (Al).[1]				
Amana (Am, and part of An).	0 to 15	Silt loam	ML or CL	A-6(8) to A-7-6(12)
	15 to 48	Silty clay loam	ML or CL	A-7-6(11-15)
	48 to 62	Silt loam	ML or CL	A-7-6(9-12)
Atterberry (As).	0 to 13	Silt loam	ML or CL	A-6(9-12)
	13 to 50	Silty clay loam	CL	A-7-6(12-16)
	50 to 60	Silt loam	ML or CL	A-6(10) to A-7-6(13)
Atterberry, benches (At).	0 to 10	Silt loam	ML or CL	A-6(9-12)
	10 to 40	Silty clay loam	CL	A-7-6(12-16)
	40 to 50	Silt loam	ML or CL	A-6(10) to A-7-6(13)
[illegible]	0 to 6	Loam or silt loam	ML or CL	A-4(8) to A-6(12)

significant in engineering

Percentage passing sieve—			Permeability	Available water capacity	Reaction	Shrink-swell potential	Other significant factors
No. 4	No. 10	No. 200					
			Inches per hour	*Inches per inch of soil*	*pH*		
95 to 100	80 to 95	60 to 80	0. 2 to 0. 8	0. 17	6. 6 to 7. 3	Moderate.	Seasonally wet and seepy.
95 to 100	80 to 95	55 to 80	0. 05 to 0. 2	. 15	5. 2 to 6. 0	High.	
95 to 100	80 to 95	55 to 80	0. 2 to 0. 8	. 15	6. 1 to 6. 5	Moderate.	
95 to 100	80 to 95	65 to 80	0. 2 to 0. 8	. 17	6. 6 to 7. 3	Moderate to high.	Seasonally wet and seepy.
95 to 100	80 to 95	65 to 80	<0. 05	. 16	5. 2 to 5. 8	High.	
95 to 100	80 to 95	55 to 80	0. 05 to 0. 2	. 15	6. 1 to 6. 5	Moderate to high.	
----------	100	95 to 100	0. 8 to 2. 5	. 20	5. 8 to 6. 6	Moderate.	Generally flooded in spring and occasionally at other times; seasonal high water table.
----------	100	95 to 100	0. 8 to 2. 5	. 19	5. 6 to 6. 0	Moderate to high.	

TABLE 4.—*Estimates of soil properties*

Soil series and map symbol	Depth from surface	Classification		
		USDA texture	Unified	AASHO
	Inches			
Colo (Co and part of Ct).	0 to 43	Silty clay loam	CH or OL	A-7-6(12-16)
	43 to 60	Silty clay loam	CL	A-7-6(11-15)
Colo, overwash (Cs).	0 to 18	Silt loam	CL or ML	A-6(10) to A-7-6(14)
	18 to 50	Silty clay loam	OL or CL	A-7-6(12-16)
Coppock (Cu).	0 to 9	Silt loam	ML or CL	A-6(8-12)
	9 to 24	Silt loam	ML or CL	A-6(8-10)
	24 to 49	Silty clay loam	CL or CH	A-7-6(14-17)
	49 to 62	Silty clay loam	CL	A-7-6(11-14)
Dickinson (DcA, DcB, DcC).	0 to 15	Sandy loam	SM or SC	A-2 or A-4
	15 to 30	Sandy loam	SM or SC	A-2 or A-4
	30 to 52	Loamy sand	SM	A-2-4
Dinsdale (DdB, DdC).	0 to 17	Silty clay loam	CL	A-6(9-12)
	17 to 31	Silty clay loam	CL	A-7-6(12-16)
	31 to 50	Loam	CL	A-6(6-10)
	50 to 65	Loam	CL	A-6(6-10)
Downs (DoB, DoC, DoC2, DoD2, DoE2, DsD3, DsE3).	0 to 13	Silt loam	ML or CL	A-4(6-8)
	13 to 49	Silty clay loam	CL	A-6(8) to A-7-6(12)
	49 to 60	Silt loam	ML or CL	A-6(6) to A-7-6(10)
[illegible]	0 to 10	Silt loam	ML or CL	A-4(6-8)

significant in engineering—Continued

Percentage passing sieve— No. 4	No. 10	No. 200	Permeability	Available water capacity	Reaction	Shrink-swell potential	Other significant factors
			Inches per hour	*Inches per inch of soil*	*pH*		
----------	100	95 to 100	0. 2 to 0. 8	0. 21	6. 0 to 6. 6	Moderate to high.	Subject to flooding; seasonal high water table.
----------	100	95 to 100	0. 2 to 0. 8	. 19	6. 0 to 6. 8	Moderate to high.	
----------	100	95 to 100	0. 8 to 2. 5	. 19	6. 0 to 6. 8	Moderate.	Frequently flooded for short periods.
----------	100	95 to 100	0. 2 to 0. 8	. 21	6. 0 to 6. 8	Moderate	

TABLE 4.—*Estimates of soil properties*

Soil series and map symbol	Depth from surface	Classification		
		USDA texture	Unified	AASHO
	Inches			
Jackson (Ja).	0 to 11	Silt loam	ML or CL	A-4(8) to A-6(12)
	11 to 53	Silty clay loam	CL	A-7-6(11-14)
	53 to 70	Silt loam	CL	A-4(8) to A-6(12)
Judson (JuB).	0 to 38	Silt loam to silty clay loam.	CL or OL	A-6(9) to A-7-6(13)
	38 to 50	Silty clay loam	CL	A-6(10) to A-7-6(12)

significant in engineering—Continued

Percentage passing sieve—			Permeability	Available water capacity	Reaction	Shrink-swell potential	Other significant factors
No. 4	No. 10	No. 200					
			Inches per hour	*Inches per inch of soil*	*pH*		
-----------	100	95 to 100	0. 8 to 2. 5	0. 19	5. 6 to 6. 6	Moderate.	Some areas flooded for short periods during high flood stages; seasonal high water table at or near the surface.
-----------	100	95 to 100	0. 8 to 2. 5	. 18	5. 6 to 6. 6	Moderate to high.	
-----------	100	95 to 100	0. 8 to 2. 5	. 17	6. 0 to 6. 6	Moderate.	
-----------	100	90 to 100	0. 8 to 2. 5	. 22	5. 6 to 6. 6	Moderate.	Water table generally below depth of 5 feet; seepy spots in some places.
-----------	100	90 to 100	0. 8 to 2. 5	. 19	6. 0 to 6. 6	Moderate.	
95 to 100	80 to 90	55 to 65	0. 8 to 2. 5	. 20	5. 4 to 6. 4	Moderate.	Some gravel and stones in lower part of profile; sand pockets in the till; water table normally at depth of more than 5 feet.
95 to 100	80 to 90	50 to 65	0. 8 to 2. 5	. 18	5. 0 to 6. 2	Moderate.	
95 to 100	80 to 90	50 to 65	0. 8 to 2. 5	. 17	6. 6 to 7. 3	Moderate.	
-----------	100	95 to 100	0. 8 to 2. 5	. 18	6. 0 to 6. 6	Moderate.	Seasonal high water table at or near the surface.
-----------	100	95 to 100	0. 8 to 2. 5	. 16	5. 0 to 6. 0	Low to moderate.	
-----------	100	95 to 100	0. 2 to 0. 8	. 18	5. 0 to 6. 0	High.	
-----------	100	95 to 100	0. 2 to 0. 8	. 17	5. 0 to 6. 6	Moderate to high.	
95 to 100	80 to 90	60 to 80	0. 8 to 2. 5	. 17	6. 0 to 6. 6	Moderate.	Seepy line generally occurs upslope, where glacial till contacts loess.
95 to 100	80 to 90	55 to 70	0. 05 to 0. 2	. 16	5. 0 to 6. 0	Moderate to high.	
95 to 100	80 to 90	55 to 70	0. 2 to 0. 8	. 15	6. 0 to 6. 8	Moderate.	
-----------	100	95 to 100	0. 8 to 2. 5	. 18	5. 8 to 6. 6	Moderate.	Some areas flooded for short periods during extremely high flood stages; seasonal high water table.
-----------	100	95 to 100	0. 2 to 0. 8	. 17	5. 0 to 6. 6	Moderate to high.	
-----------	100	95 to 100	0. 8 to 2. 5	. 18	6. 0 to 6. 6	Moderate to high.	Water table generally below depth of 10 feet.
-----------	100	95 to 100	0. 2 to 0. 8	. 17	5. 0 to 6. 2	Moderate to high.	
-----------	100	95 to 100	0. 8 to 2. 5	. 18	6. 0 to 6. 6	Moderate to high.	Receives local runoff from adjacent higher areas; sandy substratum in places below depth of 4 or 5 feet; water table normally below depth of 10 feet.
-----------	100	95 to 100	0. 2 to 0. 8	. 17	5. 6 to 6. 2	Moderate to high.	
100	80 to 90	25 to 50	2. 5 to 5. 0	. 06	5. 0 to 6. 0	Low.	Water table normally at depth of more than 10 feet.
100	80 to 90	25 to 50	2. 5 to 5. 0	. 04	5. 6 to 6. 0	Low.	
100	75 to 90	20 to 35	5. 0 to 10. 0	. 02	5. 0 to 6. 0	Very low.	
95 to 100	80 to 100	55 to 75	0. 2 to 0. 8	. 19	6. 0 to 6. 8	Moderate to high.	Some areas flooded for short periods during extremely high flood stages; seasonal high water table commonly at or near the surface.
95 to 100	80 to 100	55 to 75	0. 2 to 0. 8	. 15	5. 5 to 6. 5	Moderate.	
85 to 95	75 to 90	10 to 35	5. 0 to 10. 0	. 04	5. 5 to 6. 5	Low.	
100	95 to 100	80 to 100	0. 8 to 2. 5	. 22	6. 0 to 6. 8	Moderate to high.	Subject to flooding; thin sandy strata in the subsoil, in some places.
100	95 to 100	80 to 100	0. 8 to 2. 5	. 19	6. 0 to 6. 8	Moderate to high.	
95 to 100	80 to 100	25 to 45	2. 5 to 5. 0	. 10	6. 0 to 6. 8	Low.	
85 to 95	80 to 90	55 to 65	0. 8 to 2. 5	. 17	5. 0 to 6. 5	Moderate.	Scattered pockets of sand or gravel in the till; water table normally below depth of 10 feet.
85 to 95	80 to 90	50 to 65	0. 2 to 0. 8	. 16	5. 0 to 6. 2	Moderate.	
85 to 95	80 to 90	50 to 65	0. 8 to 2. 5	. 16	6. 0 to 6. 8	Moderate.	

TABLE 4.—*Estimates of soil properties*

Soil series and map symbol	Depth from surface	Classification		
		USDA texture	Unified	AASHO
	Inches			
Mahaska (Ma).	0 to 20	Silty clay loam	CL or OL	A-7-6(11-14)
	20 to 49	Silty clay loam	MH or CH	A-7-6(16-20)
	49 to 73	Silt loam	CL	A-7-6(14-16)
Muscatine (Mu).	0 to 17	Silty clay loam	CL or OL	A-7-6(11-14)
	17 to 46	Silty clay loam	CL or CH	A-7-6(15-18)
	46 to 60	Silt loam	CL	A-6(12) to A-7-6(14)
[illegible]	0 to 20	Silty clay loam	CL or OL	A-6(9) to A-7-6(14)

significant in engineering—Continued

Percentage passing sieve— No. 4	Percentage passing sieve— No. 10	Percentage passing sieve— No. 200	Permeability	Available water capacity	Reaction	Shrink-swell potential	Other significant factors
			Inches per hour	*Inches per inch of soil*	*pH*		
----------	100	95 to 100	0. 8 to 2. 5	0. 23	6. 0 to 6. 8	Moderate to high.	Seasonal high water table normally at or near the surface.
----------	100	95 to 100	0. 2 to 0. 8	. 20	5. 6 to 6. 6	High.	
----------	100	95 to 100	0. 2 to 2. 5	. 17	6. 0 to 6. 8	Moderate to high.	
----------	100	95 to 100	0. 8 to 2. 5	. 23	6. 0 to 6. 8	Moderate to high.	Seasonal high water table normally at or near the surface.
----------	100	95 to 100	0. 2 to 0. 8	. 20	5. 6 to 6. 6	High.	
----------	100	95 to 100	0. 8 to 2. 5	. 17	6. 0 to 6. 8	Moderate.	
100	95 to 100	80 to 100	0. 8 to 2. 5	. 23	5. 8 to 6. 6	Moderate to high.	Some areas flooded for short periods during high flood stages; seasonal high water table normally at or near the surface.
100	95 to 100	80 to 100	0. 2 to 0. 8	. 20	5. 8 to 6. 6	High.	
100	95 to 100	80 to 100	0. 2 to 0. 8	. 17	5. 8 to 6. 6	Moderate to high.	
100	95 to 100	90 to 100	0. 8 to 2. 5	. 19	6. 6 to 7. 3	Moderate.	Frequently flooded; water stands in some oxbows and old channels.
100	95 to 100	90 to 100	0. 8 to 2. 5	. 22	6. 6 to 7. 3	Moderate to high.	
100	95 to 100	90 to 100	0. 8 to 2. 5	. 19	6. 6 to 7. 3	Moderate.	Frequently flooded; seasonal high water table normally at or near the surface.
----------	100	95 to 100	0. 2 to 0. 8	. 21	6. 6 to 7. 3	High.	
----------	100	95 to 100	0. 2 to 2. 5	. 21	6. 0 to 7. 3	Moderate.	Water table below depth of 10 feet.
----------	100	95 to 100	0. 2 to 0. 8	. 19	5. 6 to 6. 0	Moderate to high.	
----------	100	95 to 100	0. 2 to 2. 5	. 18	6. 0 to 7. 3	Moderate to high.	
----------	100	95 to 100	0. 2 to 2. 5	. 21	6. 0 to 7. 3	Moderate.	Receives local runoff from adjacent higher areas; water table below depth of 5 feet; sandy substratum at depth of 4 or
----------	100	95 to 100	0. 2 to 0. 8	. 19	5. 6 to 6. 0	Moderate to high.	
	100	95 to 100	0. 2 to 0. 8	. 18	6. 0 to 7. 3	Moderate	

TABLE 4.—*Estimates of soil properties*

Soil series and map symbol	Depth from surface	Classification		
		USDA texture	Unified	AASHO
	Inches			
Tama, benches (ThA, ThB).	0 to 15	Silty clay loam	ML or CL	A-6(10) to A-7-5(13)
	15 to 40	Silty clay loam	CL	A-7-6(12-14)
	40 to 50	Silt loam	CL	A-6(9-12)

significant in engineering—Continued

Percentage passing sieve—			Permeability	Available water capacity	Reaction	Shrink-swell potential	Other significant factors
No. 4	No. 10	No. 200					
			Inches per hour	*Inches per inch of soil*	*pH*		
----------	100	95 to 100	0.8 to 2.5	0.22	5.8 to 6.8	Moderate.	Receives runoff from adjacent higher areas; water table below depth of 10 feet.
----------	100	95 to 100	0.8 to 2.5	.19	5.6 to 6.0	Moderate to high.	
----------	100	95 to 100	0.8 to 2.5	.17	6.0 to 6.8	Moderate.	
----------	100	95 to 100	0.8 to 2.5	.18	5.0 to 6.6	Moderate.	Seasonally seepy areas downslope where glacial till outcrops.
----------	100	95 to 100	0.8 to 2.5	.17	5.0 to 5.5	Moderate to high.	
100	90 to 100	55 to 70	0.8 to 2.5	.15	5.0 to 5.5	Moderate.	
100	90 to 100	5 to 20	5.0 to 10.0	.04	4.5 to 5.5	Low to none.	
100	80 to 100	60 to 80	0.8 to 2.5	.18	6.0 to 6.6	Moderate.	Seasonal high water table at at depth of 2 or 3 feet; some areas subject to flooding during extremely high flood stages.
100	80 to 100	60 to 80	0.8 to 2.5	.17	5.6 to 6.0	Moderate.	
80 to 95	70 to 90	10 to 35	2.5 to 5.0	.10	5.0 to 6.0	Low.	
80 to 95	70 to 90	10 to 35	5.0 to 10.0	.06	5.0 to 6.0	Low.	
100	100	95 to 100	< 0.05	.18	6.0 to 7.0	High.	Subject to flooding; commonly ponded in spring.
100	100	95 to 100	< 0.05	.16	6.6 to 7.3	High.	
----------	100	95 to 100	0.8 to 2.5	.18	6.0 to 6.6	Moderate.	Receives runoff from adjacent higher areas; seasonal high water table at or near the surface.
----------	100	95 to 100	0.2 to 0.8	.17	5.4 to 6.0	Moderate to high.	
----------	100	95 to 100	0.8 to 2.5	.16	6.0 to 7.0	Moderate.	
----------	100	85 to 95	0.8 to 2.5	.18	5.6 to 6.6	Moderate.	Water table at depth of 5 feet or more.
----------	100	85 to 95	0.2 to 0.8	.17	5.6 to 6.6	Moderate to high.	
----------	100	85 to 95	0.2 to 0.8	.16	5.6 to 6.6	Moderate to high.	
----------	100	95 to 100	0.8 to 2.5	.20	6.0 to 7.0	Moderate.	A sand layer, as much as 6 inches thick, occurs in many places between the loess and underlying glacial till; this layer contains free water and contributes to seepage that forms on side slopes during wet periods; sand pockets and boulders in till.
----------	100	95 to 100	0.8 to 2.5	.19	5.6 to 6.0	Moderate to high.	
95 to 100	80 to 90	50 to 65	0.8 to 2.5	.16	5.0 to 6.6	Moderate.	
95 to 100	80 to 90	50 to 65	0.8 to 2.5	.15	6.6 to 7.4	Moderate.	
100	95 to 100	70 to 80	0.8 to 2.5	.18	6.0 to 6.6	Moderate.	Water table at depth of 5 feet or more.
100	95 to 100	70 to 80	0.8 to 2.5	.16	5.6 to 6.0	Moderate.	
90 to 100	90 to 95	5 to 20	5.0 to 10.0	.02	5.6 to 6.0	Low to none.	
----------	100	85 to 95	0.8 to 2.5	.20	5.6 to 6.6	Moderate.	Some areas flooded for short periods during extremely high flood stages; water table generally below depth of 5 feet or more.
----------	100	85 to 95	0.8 to 2.5	.18	5.6 to 6.0	Moderate to high.	
----------	100	70 to 90	0.8 to 2.5	.16	5.6 to 6.6	Moderate.	
----------	100	90 to 100	0.05 to 0.2	.19	5.6 to 6.6	High.	Subject to flooding; seasonal high water table at or near the surface.
----------	100	90 to 100	0.05 to 0.2	.18	5.6 to 6.6	High.	

In soils derived from loess, the seasonal water table generally is above the contact of the loess and the glacial till. In the more nearly level areas, a perched water table occurs in places above the plastic B horizon. In these areas the in-place density of the loess is relatively low, and the moisture content is high. This high moisture content may cause instability in embankments unless it is controlled enough to permit the soil to be compacted to high density.

Because of their high in-place density, soils derived from glacial till generally do not have an excessively high moisture content and are more easily compacted than the soils derived from loess.

Such soils as the Kenyon and Bassett developed from loam till in the northeastern part of the county. These soils are sandy loams and loams and are classified A–4, A–6 (CL). Where this till occurs, sand pockets and sand lenses can be anticipated. Frost heaving is likely if the sand, holding large quantities of free water, is overlain by a fine-grained soil and is within the frost penetration zone. A perched water table may be encountered where a layer or a pocket of sand overlies a layer of clay.

On the nearly level to gently rolling uplands, under a mantle of loess, are the remains of the original Kansan till plain. This glacial till is heterogeneous and of fair quality for construction work. The upper layer is a very plastic clay and is classified A–7–6 (19–20). It is not stable enough to be used for highway subgrades and should not be used in fills that are within 5 feet of the finished grade. On slopes where the loess is thin, this plastic clay crops out, and the Adair soils have formed. If this clay material occurs at grade in roadcuts, it should

TABLE 5.—*Interpretation of*

Soil series and map symbol	Suitability as source of—				Soil features affecting—	
	Topsoil	Sand	Gravel	Road fill	Highway location	Construction of farm ponds: Reservoir area
Adair, thin solum (AcD2, AcE2, AeD3, AeE3, AeF3).	Poor	Not suitable	Not suitable	Very poor to depth of about 4 feet; fair or good below depth of 4 feet; large volume change; highly elastic.	Rolling topography; seasonal seepage likely in cuts; difficult to vegetate.	Very slow permeability if compacted; easily compacted at optimum moisture; suitable sites common.
Adair (AaC2, AaD2, AaE2, AdD3, AdE3).	Poor	Not suitable	Not suitable	Not suitable to depth of 4 or 5 feet; should not be used within 5 feet of finished grade; slight to large volume change; slightly elastic.	Rolling topography; seasonally seepy and wet; difficult to vegetate.	Very slow permeability if compacted; easily compacted at optimum moisture; suitable sites common.
Alluvial land (Al)	Good to poor; check each site.	Fair; some areas contain stratified fine sand and medium sand; low in coarse sand or gravel.	Not suitable	Variable; good to not suitable; check each area.	Soil materials variable; subject to frequent flooding; seasonal high water table.	Permeability varies; stratified sand and silt; fluctuating water table; many areas too porous to hold water; suitable sites unlikely.

See footnotes at end of table.

be removed to a depth of 2 feet and should be replaced with a backfill of good glacial till or of coarse-textured soil.

Below the clayey layer is heterogeneous Kansan till that is classified primarily A–6 (CL). This till outcrops on the lower part of slopes and is the parent material of the Gara, Lindley, and Shelby soils. If this till occurs in or along grading projects, it generally is placed in the upper subgrade in unstable areas. Pockets and lenses of sand commonly are interspersed throughout the till and in many places are water bearing. Frost heaving is likely if the road grade is only a few feet above such deposits and the deposits are overlain by loess or loamy till. To prevent frost heaving, these deposits can be drained, or the soil above them can be replaced with a backfill of coarse-textured material or good glacial till.

The soils on bottom lands developed from recent alluvium washed from hills and uplands. Such soils as Colo, Bremer, and Ely have a thick organic surface layer that may consolidate erratically under an embankment load. These soils are classified A–7(CH–CL). They have low in-place density and a high content of moisture. Therefore, if an embankment is to be more than 15 feet in height, these soils should be carefully analyzed to be sure that they are strong enough to support it. Roadways through bottom lands should be constructed on a continuous embankment that extends above the flood level.

Bedrock in Iowa County is at such a depth below the glacial and loessal deposits that it plays no major part in development of the soils.

Included in table 5 are ratings that show the suitability of the soils of the county as a source of topsoil that can be used to promote the growth of vegetation on embankments and cutslopes and as a source of borrow for road construction.

engineering properties of soils

Soil features affecting—Continued					Degree of limitation for—	
Construction of farm ponds—Con.: Embankment	Agricultural drainage	Irrigation	Terraces and diversions	Waterways	Septic tank fields	Foundations for low buildings [1]
Fair or good stability; moderate or high shrink-swell potential; good for impervious cores.	Wetness caused by seepage; interceptor tile placed above the seepage areas is helpful.	Very slow permeability; subject to erosion; low agricultural value.	Subsoil unfavorable for crop growth; exposed subsoil difficult to vegetate; terrace channels likely to be seepy.	Low fertility; tile needed in many waterways to control seepage.	Severe; very slowly permeable.	Moderate; low compressibility; uneven consolidation; often seepy and wet.
Fair or good	Wetness caused	Very slow	Subsoil unfavor-	Low fertility; tile	Severe; very slow-	Moderate; low

TABLE 5.—*Interpretation of*

Soil series and map symbol	Suitability as source of—				Soil features affecting—	
	Topsoil	Sand	Gravel	Road fill	Highway location	Construction of farm ponds: Reservoir area
Amana (Am and part of An).	Good	Not suitable	Not suitable	Fair or poor; poor bearing capacity; poor workability; difficult to compact to high density.	Nearly level topography; seasonal high water table; subject to flooding.	Level topography; fluctuating water table; seepage can be expected even if soil is compacted.
Atterberry (As)	Fair; only thin layer contains organic matter.	Not suitable	Not suitable	Fair or poor; fair bearing capacity, but poor shear strength; moderate or high shrink-swell potential	Seasonal high water table; low borrow potential.	Seepage can be expected even if soil is compacted; sites generally not available.

engineering properties of soils—Continued

Soil features affecting—Continued					Degree of limitation for—	
Construction of farm ponds—Con.: Embankment	Agricultural drainage	Irrigation	Terraces and diversions	Waterways	Septic tank fields	Foundations for low buildings[1]
Fair stability; high compressibility; fair or poor compaction.	Subject to flooding; tile drains suitable; surface drains needed in some places; flood protection needed.	High available moisture holding capacity; medium intake rate; some areas require drainage and protection from flooding before irrigating.	Not needed, because of topography.	Not needed, because of topography.	Severe; seasonal high water table; subject to flooding, especially in spring.	Severe; subject to flooding; high compressibility.
Fair stability; medium compressibility; fair compaction at optimum moisture; moderate or high expansion potential.	Seasonal high water table; tile functions well; many areas do not require tile drainage.	High available moisture holding capacity; moderate intake rate; some areas may benefit from tiling before irrigating.	Not needed, because of topography.	Not needed, because of topography.	Moderate, unless drained; seasonal high water table.	Moderate; moderate compressibility; uniform consolidation; may lose cohesion and settle if saturated.
Fair stability and compaction; poor resistance to	Seasonal high water table; tile functions well; many	High available moisture holding capacity;	Suitable for diversions to protect soils from runoff from	Seepage on sides of waterways; tile needed to permit vegeta-	Moderate, unless drained; seasonal high water table.	Moderate; moderate compressibility; uniform consolidation;

TABLE 5.—*Interpretation of*

Soil series and map symbol	Suitability as source of—				Soil features affecting—	
	Topsoil	Sand	Gravel	Road fill	Highway location	Construction of farm ponds
						Reservoir area
Bremer (Bs)	Poor	Not suitable	Not suitable	Not suitable; poor bearing capacity, high expansion potential; highly elastic; difficult to compact to high density.	Low borrow potential; seasonal high water table; uppermost 2 feet high in organic-matter content.	Slow permeability if compacted; nearly level topography; suitable sites unlikely.
Bremer, overwash (Bt)	Good in overwash; poor below overwash.	Not suitable	Not suitable	Fair or poor in overwash; not suitable below overwash; poor bearing capacity; high expansion potential; highly elastic.	Low borrow potential; seasonal high water table; high organic-matter content below overwash; subject to local flooding for short periods.	Nearly level topography; slow permeability if compacted; suitable sites unlikely.
Chariton (Ca)	Poor; water	Not suitable	Not suitable	Not suitable;	Low borrow	Slow permeability;

engineering properties of soils—Continued

Soil features affecting—Continued					Degree of limitation for—	
Construction of farm ponds—Con.: Embankment	Agricultural drainage	Irrigation	Terraces and diversions	Waterways	Septic tank fields	Foundations for low buildings[1]
Fair stability; high in organic-matter content in uppermost 2 feet; poor workability when wet; high com-	Seasonal high water table; tile functions satisfactorily in most areas; surface drains beneficial in some areas.	High available moisture holding capacity; moderately slow intake rate; tile needed before irrigating	Terraces not needed; diversions help to protect soils from overflow from adjacent sloping soils.	Not needed, because of topography.	Severe; seasonal high water table; slowly permeable.	Moderate or severe; high compressibility; high water table; subject to dangerous expansion if initially dry.

TABLE 5.—*Interpretation of*

Soil series and map symbol	Suitability as source of—				Soil features affecting—	
	Topsoil	Sand	Gravel	Road fill	Highway	Construction of farm ponds

engineering properties of soils—Continued

Soil features affecting—Continued					Degree of limitation for—	
Construction of farm ponds—Con.	Agricultural		Terraces and		Septic tank	Foundations for

TABLE 5.—*Interpretation of*

Soil series and map symbol	Suitability as source of—				Soil features affecting—	
	Topsoil	Sand	Gravel	Road fill	Highway location	Construction of farm ponds: Reservoir area
Downs (DoB, DoC, DoC2, DoD2, DoE2, DsD3, DsE3).	Fair or good; only thin layer contains organic matter.	Not suitable	Not suitable	Fair; fair bearing capacity; fair or good workability; large volume change and loss of bearing capacity when wet.	Rolling topography; high moisture content likely in deep cuts; easy to vegetate; low borrow potential.	Some seepage can be expected; reservoir bottom should be scarified and compacted.
Downs, benches (DpB)	Good	Generally not suitable; poorly graded sand below depth of 4 feet in some places.	Not suitable	Fair in uppermost 4 feet, good below depth of 4 feet; fair or good bearing capacity; fair or good workability.	Low borrow potential; fairly stable and easy to vegetate.	Coarse strata encountered below depth of 4 feet in some places; reservoir bottom should be scarified and compacted.
Ely (EsB and parts of Ct and Nx).	Good	Not suitable	Not suitable	Poor; moderate or high expansion potential; poor bearing capacity; difficult to compact to high density.	High in organic-matter content; seasonal high water table; subject to local flooding for short periods.	Coarse-textured layer occurs in places below depth of 4 feet; reservoir bottom should be scarified and compacted.
Fayette (FaB, FaC, FaC2, FaD, FaD2, FaE, FaE2, FaF, FaF2, FaG, FsD3, FsE3, FsF3, and parts of CfC, CfD, CfD2, CfE, CfE2, CfG).	Poor; only thin layer contains organic matter.	Not suitable	Not suitable	Fair; fair bearing capacity; fair or good workability; low density material; narrow range of moisture content for satisfactory compaction.	Rolling topography; fairly stable; easy to vegetate; water table may be encountered in deep cuts; low borrow potential.	Some seepage can be expected; reservoir bottom should be scarified and compacted.
Fayette, benches (FbB)	Poor; only thin layer contains organic matter.	Generally not suitable; poorly graded sand below depth of 4 feet in some places.	Not suitable	Fair; good below depth of 4 feet if sand is encountered; fair bearing capacity above 4 feet; low density material in upper horizon.	Low borrow potential in uppermost 4 feet; fair stability; easy to vegetate except where coarse strata occur.	Coarse strata below depth of 4 feet in some places; reservoir bottom should be scarified and compacted.

See footnotes at end of table.

engineering properties of soils—Continued

Soil features affecting—Continued					Degree of limitation for—	
Construction of farm ponds—Con. Embankment	Agricultural drainage	Irrigation	Terraces and diversions	Waterways	Septic tank fields	Foundations for low buildings[1]
Fair stability; compacts readily at optimum moisture; poor compaction above optimum moisture; medium or high compressibility.	Not needed	Moderate intake rate; high available moisture holding capacity; erosion control practices needed.	Well suited on slopes of less than 12 percent.	Seepage on sides of waterways; tile needed to permit vegetation to become established.	Slight on slopes of less than 10 percent.	Moderate; medium or high compressibility; uniform consolidation; fair or poor bearing capacity.
Fair stability; compacts readily at optimum moisture; poor resistance to piping in places.	Not needed	Moderate intake rate; high available moisture holding capacity.	Terraces suitable; diversions where needed above benches help to protect soils from local runoff.	Well suited	Slight, moderately permeable.	Moderate; medium or high compressibility; uniform consolidation; fair or poor bearing capacity.
Adequate strength and stability; moderate or high expan-	Wetness caused by seepage; interceptor tile needed.	Moderate intake rate; high available moisture holding ca-	Terraces not needed; diversions properly placed help to protect from	Seepage on sides of drainageways; tile needed to permit vegetation	Moderate or severe; seasonal high water table.	Severe; fair or poor bearing capacity; moderate or high compressi-

TABLE 5.—*Interpretation of*

Soil series and map symbol	Suitability as source of—				Soil features affecting—	
	Topsoil	Sand	Gravel	Road fill	Highway location	Construction of farm ponds
						Reservoir area
Gara (GaC2, GaD2, GaE2, GaF2, GrD3, GrE3, GrF3).	Fair; only thin layer contains organic matter.	Not suitable	Not suitable	Good; fair or good bearing capacity; good workability and compaction; easily compacted to high density.	Rolling topography; soil material variable in cuts; some cuts likely to be seepy; good borrow potential.	Slow permeability if compacted; suitable sites likely.
Givin (Gs)	Fair	Not suitable	Not suitable	Very poor; low bearing capacity when	Seasonal high water table; low borrow	Slow permeability if compacted; suitable sites

engineering properties of soils—Continued

Soil features affecting—Continued					Degree of limitation for—	
Construction of farm ponds—Con.: Embankment	Agricultural drainage	Irrigation	Terraces and diversions	Waterways	Septic tank fields	Foundations for low buildings[1]
Adequate stability; easily compacted to high density; good workability; good for cores.	Seasonally seepy; interceptor tile helps to control seepage at contact of loess and till.	High rate of runoff; subject to erosion; high available moisture holding capacity; erosion control practices needed.	Suitable on slopes of less than 12 percent; cuts should be held to a minimum because of less productive subsoil.	Seepage on sides of waterways; tile needed to permit vegetation to become established.	Moderate on slopes of less than 10 percent; moderately slowly permeable.	Slight; good bearing capacity and shear strength; low compressibility; uneven consolidation.
Fair stability; moderate or high shrink-swell potential; poor compaction when wet.	Seasonal high water table; tile functions satisfactorily; surface drains beneficial in depressions.	Somewhat poorly drained; high available moisture holding capacity; tile drainage needed.	Not needed, because of topography.	Not needed, because of topography.	Severe, unless tile drained; seasonal high water table; moderately slowly permeable.	Moderate or severe; moderate or high compressibility; uniform consolidation; seasonal high water table.
Seepage rate high; highly erodible; low shrink-swell potential; poor resistance to piping.	Not needed	Low available moisture holding capacity; rapid permeability.	Highly erodible; difficult to build and maintain terrace ridges and channels; suitability questionable.	Highly erodible; low moisture holding capacity; difficult to vegetate.	Moderate; rapidly permeable; poor filtering material; unfiltered sewage will travel long distances.	Slight; low compressibility; fair or good shear strength; rapid consolidation; negligible volume change on wetting; may liquify if excavated when wet.
Fair stability; fair compaction at or below optimum moisture, but poor above optimum; medium or high compressibility; low shrink-swell potential.	Not needed	Medium available moisture holding capacity; medium intake rate; high rate of runoff; subject to erosion.	Suitable on slopes of less than 12 percent.	Highly erodible; vegetation difficult to establish and maintain.	Slight on slopes less than 10 percent.	Slight or moderate; medium or high compressibility; uniform consolidation; fair bearing capacity.
Fair stability; medium or high compressibility; moderate or high shrink-swell potential.	Seasonal high water table; tile functions satisfactorily; not all areas require tile.	Moderate intake rate; high available moisture holding capacity.	Not needed, because of topography.	Generally not needed, because of topography.	Moderate; seasonal high water table.	Moderate; medium or high compressibility; fair bearing strength; seasonal high water table; may liquify if excavated when wet.

TABLE 5.—*Interpretation of*

Soil series and map symbol	Suitability as source of—				Soil features affecting—	
	Topsoil	Sand	Gravel	Road fill	Highway location	Construction of farm ponds: Reservoir area
Judson (JuB)	Excellent	Not suitable	Not suitable	Not suitable; high in organic-matter content in uppermost 2 or 3 feet; fair or poor bearing capacity; difficult to compact to	Subject to flooding by local runoff; seepy in some places; low borrow potential; high in organic-matter content.	Reservoir bottom should be scarified and compacted.

engineering properties of soils—Continued

Soil features affecting—Continued					Degree of limitation for—	
Construction of farm ponds—Con. Embankment	Agricultural drainage	Irrigation	Terraces and diversions	Waterways	Septic tank fields	Foundations for low buildings[1]
Fair stability; high compressibility; moderate expansion potential; fair compaction at optimum moisture.	Seasonally seepy; most areas do not need tile; interceptor tile needed in seepy areas.	High available moisture holding capacity; moderate intake rate; yield potential favorable.	Terraces not needed; diversions help to protect soils from local overflow.	Well suited; tile helpful in controlling seepage when vegetation is established.	Slight or moderate; periodic overflow may cause damage to filter fields.	Moderate; high compressibility; fair or poor bearing capacity and shear strength.
Adequate strength and stability; good compaction characteristics; low compressibility; good for cores.	Not needed	Moderate intake rate; high available moisture holding capacity.	Suitable, but cuts should be held to a minimum, generally less than 2 feet; wet spots may develop but can be drained by tile.	Seepage on sides of waterways; tile needed to permit vegetation to become established.	Slight or moderate on slopes of less than 10 percent.	Slight; good bearing capacity and shear strength; low compressibility; uneven consolidation in some places.
Fair stability; high shrink-swell potential; difficult to compact to high density when wet.	Seasonal high water table; tile functions satisfactorily; some areas do not require tile.	Moderate intake rate; moderately slow permeability; high available moisture holding capacity.	Not needed, because of topography.	Not needed, because of topography.	Severe; moderately slowly permeable; seasonal high water table.	Moderate or severe; poor bearing capacity; moderate or high compressibility; uniform consolidation; high water table.
Good stability; can be used for impervious core; moderate or high shrink-swell potential; good	Wetness because of seepage; interceptor tile needed at contact of loess and till.	High available moisture holding capacity; slow or very slow permeability; subject to runoff; low	Subsoil unfavorable; terrace channels may be wet and seepy; cuts should be held to a minimum; slopes com-	Seepage on sides of waterways; tile needed to permit vegetation to become established.	Severe; slowly to very slowly permeable; seasonally wet and seepy.	Slight or moderate; low compressibility; good bearing capacity below depth of 4 feet; highly expansive if subject

TABLE 5.—*Interpretation of*

Soil series and map symbol	Suitability as source of—				Soil features affecting—	
	Topsoil	Sand	Gravel	Road fill	Highway location	Construction of farm ponds — Reservoir area
Ladoga (LaB, LaC, LaC2, LaD, LaD2, LaE2, LdD3, LdE3).	Fair or poor; only thin layer contains organic matter.	Not suitable	Not suitable	Poor; fair bearing capacity; poor shear strength; moderate or high shrink-swell potential.	Rolling topography; high moisture content in some deep cuts; low borrow potential.	Reservoir bottom of uniform material; slow permeability if compacted.
Ladoga, benches (LbB)	Fair; only thin layer contains organic matter.	Not suitable	Not suitable	Poor; fair bearing capacity; poor shear strength; moderate or high shrink-swell potential.	Gently sloping topography; subject to flooding by local runoff from adjacent slopes; low borrow potential.	Reservoir bottom of uniform material; slow permeability if compacted; sand strata below depth of 4 feet in some places.
Lamont (Parts of CfC, CfD, CfD2, CfE, CfE2, CfG).	Fair; only thin layer contains organic matter.	Good; poorly graded.	Not suitable	Good; good workability and compaction; low shrink-swell potential; low compressibility.	Highly erodible; good workability, except where fines are less than 15 percent; deep cuts likely to be seasonally seepy.	Material too porous to hold water.
Lawler (Le)	Excellent	Suitable be-	Not suitable	Very poor in	Highly suscep-	Sand strata below

engineering properties of soils—Continued

Soil features affecting—Continued					Degree of limitation for—	
Construction of farm ponds—Con.: Embankment	Agricultural drainage	Irrigation	Terraces and diversions	Waterways	Septic tank fields	Foundations for low buildings[1]
Fair stability;	Generally not	Moderate in-	Suitable on slopes	Seepage on sides	Slight or mod-	Moderate; fair

TABLE 5.—*Interpretation of*

Soil series and map symbol	Suitability as source of—				Soil features affecting—	
	Topsoil	Sand	Gravel	Road fill	Highway location	Construction of farm ponds
						Reservoir area
Lindley (LnD2, LnE2, LnF, LnF2, LnG, LsD3, LsE3, LsF3).	Poor	Not suitable	Not suitable	Good; fair or good bearing capacity; low compressibility; easily compacted to high density.	Rolling and steep topography; good source of borrow; some cuts are seepy; surface layer low in organic-matter content.	Slow permeability; good sites likely.
Mahaska (Ma)	Excellent	Not suitable	Not suitable	Not suitable; poor bearing capacity and shear strength; moderate or high shrink-swell potential; highly elastic and difficult to	Nearly level topography; uppermost 1½ feet high in organic-matter content; seasonal high water table; low borrow potential.	Slow permeability if compacted; uniform material; suitable sites unlikely.

engineering properties of soils—Continued

Soil features affecting—Continued					Degree of limitation for—	
Construction of farm ponds—Con.	Agricultural drainage	Irrigation	Terraces and diversions	Waterways	Septic tank fields	Foundations for low buildings [1]

TABLE 5.—*Interpretation of*

Soil series and map symbol	Suitability as source of—				Soil features affecting—	
	Topsoil	Sand	Gravel	Road fill	Highway location	Construction of farm ponds: Reservoir area
Nodaway, silty clay loam substratum (Ns)	Excellent	Not suitable	Not suitable	Not suitable; poor bearing	Nearly level topography;	Moderate or slow permeability if

engineering properties of soils—Continued

Soil features affecting—Continued					Degree of limitation for—	
Construction of farm ponds—Con. Embankment	Agricultural drainage	Irrigation	Terraces and diversions	Waterways	Septic tank fields	Foundations for low buildings [1]
Low stability at high moisture; poor workability and compaction above optimum moisture; moderate or high shrink-swell potential.	Seasonally wet because of flooding; tile functions satisfactorily; protection from overflow needed in many places.	Moderate intake rate; high available moisture holding capacity; subject to flooding.	Not needed, because of topography.	Generally not needed, because of topography; well suited where needed.	Severe; subject to frequent flooding.	Severe; high compressibility; even consolidation; subject to frequent flooding; low bearing capacity.
Fair stability; poor compaction above optimum moisture, but fair at or below optimum; moderate or high shrink-swell potential.	Not needed-----	Moderate intake rate; high available moisture holding capacity; subject to erosion; favorable production potential.	Suitable on slopes of less than 12 percent.	Seepage on sides of waterways; tile generally needed to permit vegetation to become established.	Slight on slopes of less than 10 percent; moderately permeable below depth of 4 feet.	Moderate; moderate compressibility; uniform consolidation; fair bearing capacity; expands if subject to wide fluctuation in moisture content.
Fair stability; poor compaction above optimum moisture, good at or below optimum; moderate or high shrink-swell potential.	Not needed-----	Moderate intake rate; high available moisture holding capacity; favorable production potential.	Soil properties suitable; diversions help to protect soils from local runoff.	Seepage on sides of waterways; tile needed to permit vegetation to become established.	Slight or moderate; moderately slowly permeable.	Moderate; moderate compressibility; uniform consolidation; fair bearing capacity.
Adequate stability; easily compacted to high density;	Seasonally seepy; interceptor tile helpful in	Subject to erosion; high available moisture	Suitable on slopes of less than 12 percent; cuts should be held	Seepage on sides of waterways; tile needed to permit vegeta-	Moderate on slopes of less than 10 percent; moder-	Slight; good bearing capacity and shear strength; low compressi-

TABLE 5.—*Interpretation of*

Soil series and map symbol	Suitability as source of—				Soil features affecting—	
	Topsoil	Sand	Gravel	Road fill	Highway location	Construction of farm ponds
						Reservoir area

engineering properties of soils—Continued

Soil features affecting—Continued						Degree of limitation for—	
Construction of farm ponds—Con.	Agricultural drainage	Irrigation	Terraces and diversions	Waterways		Septic tank fields	Foundations for low buildings[1]
Embankment							
Fair stability; poor compaction above optimum moisture, fair at or below optimum.	Seasonal high water table; tile functions satisfactorily; not needed in all areas.	Moderate intake rate; high available moisture holding capacity.	Not needed, because of topography.	Not needed, because of topography.		Moderate; seasonal high water table.	Slight or moderate; medium or high compressibility; uniform consolidation.
Fair stability; poor compaction above optimum moisture, fair	Seasonal high water table; tile functions satisfactorily; not needed	Moderate intake rate; high available moisture holding	Terraces not needed; diversions help to intercept runoff from higher	Not needed, because of topography.		Moderate; seasonal high water table.	Slight or moderate medium or high compressibility; uniform consolidation.

TABLE 5.—*Interpretation of*

Soil series and map symbol	Suitability as source of—				Soil features affecting—	
	Topsoil	Sand	Gravel	Road fill	Highway location	Construction of farm ponds: Reservoir area
Tell (TmB, TmC, TmC2, TmD2).	Fair	Suitable; poorly graded fine sand and medium sand below depth of 24 to 40 inches.	Not suitable	Fair or good; fair bearing capacity in upper part, good in substratum; low volume change with increase in moisture content; good stability if combined.	Rolling topography; loose sand at depth of 24 to 40 inches; free water likely in deep cuts; highly susceptible to frost action.	Too porous to hold water.
Udolpho (Ud)	Good	Suitable; poorly graded sand below depth of 30 to 50 inches.	Not suitable	Fair in uppermost 30 to 50 inches; moderate volume change and loss of bearing capacity when wet; good in substratum; little or no volume change on wetting; good stability if combined.	Nearly level or gently sloping topography; seasonal high water table; highly susceptible to frost action; good borrow potential.	Too porous to hold water; fluctuating water table.

engineering properties of soils—Continued

Soil features affecting—Continued					Degree of limitation for—	
Construction of farm ponds—Con. Embankment	Agricultural drainage	Irrigation	Terraces and diversions	Waterways	Septic tank fields	Foundations for low buildings [1]
Fair stability; fair or good compaction; rapid seepage rate; poor	Not needed	Moderate intake rate; moderate or low available moisture	Suitable, but cuts should be held to a minimum to prevent exposure of	Vegetation difficult if coarse strata are exposed.	Slight or moderate; poor filtering material below depth of	Slight; low or medium compressibility; fair or good bearing capacity.

TABLE 5.—*Interpretation of*

Soil series and map symbol	Suitability as source of—				Soil features affecting—	
	Topsoil	Sand	Gravel	Road fill	Highway location	Construction of farm ponds: Reservoir area
Waubeek (WmB, WmC2)	Fair to good	Not suitable	Not suitable	Fair in the loess; good in the till; fair or good bearing capacity; moderate volume change with increase in moisture content.	Seepage likely in cuts; highly susceptible to frost action where sand pockets and strata occur.	Sand pockets and lenses occur in places; reservoir bottom should be scarified and compacted.
Waukegan (WnA, WnB, WnC, WsB, WsC).	Good	Good; poorly graded sand below depth of 30 to 45 inches.	Poor; generally very small amounts of gravel below depth of 30 to 45 inches.	Fair or poor in uppermost 30 to 40 inches; good in substratum; good bearing capacity and shear strength in coarse strata; low volume change on wetting.	Coarse strata highly erodible in exposed cuts; surface layer high in organic-matter content; good borrow potential.	Too porous to hold water.

engineering properties of soils—Continued

Soil features affecting—Continued					Degree of limitation for—	
Construction of farm ponds—Con.: Embankment	Agricultural drainage	Irrigation	Terraces and diversions	Waterways	Septic tank fields	Foundations for low buildings[1]
Fair stability; good compaction and workability in till; moderate or high shrink-swell potential.	Not needed	Moderate intake rate; high available moisture holding capacity; subject to erosion.	Suitable, but cuts in terraces should be held to a minimum; subsoil low in fertility.	Seepage on sides of waterways; tile needed to permit vegetation to become established.	Slight	Slight; good bearing capacity and low compressiblity in till.
Good stability; fair or good compaction; not suitable for core; can be used in shell; mod-	Not needed	Moderate intake rate; moderate available moisture holding capacity; limit irrigation to	Suitable, but cuts should be held to a minimum to prevent exposure of sandy substratum	Well suited	Slight; poor filtering material in substratum.	Slight; low compressibility in coarse strata; good bearing capacity; negligible volume change in sub-

TABLE 6.—*Engineering test data for soil*

[Tests performed by the Iowa State Highway Commission in accordance with standard

Soil name and location	Parent material	Iowa report No. (AAD9)	Depth	Horizon	Moisture-density data[1]: Maximum dry density	Moisture-density data[1]: Optimum moisture
			Inches		*Lb. per cu. ft.*	*Percent*
Clinton silt loam: SW¼SE¼ sec. 23, T. 79 N., R. 12 W.	Loess.	10441	0 to 6	A1	92	23
		10442	10 to 28	B2	103	20
		10443	54 to 66	C1	104	19
Fayette silt loam: SW¼NE¼ sec. 3, T. 81 N., R. 11 W.	Loess.	10432	0 to 5	Ap	101	18
		10433	9 to 19	B1 and B2	102	21
		10434	49 to 71	C1	95	20
Ladoga silt loam: SE¼ sec. 26, T. 80 N., R. 11 W.	Loess.	10451	0 to 8	A1	94	22
		10452	12 to 32	B2	98	20
		10453	55 to 72	C1	108	16
Lindley loam: SW¼NE¼ sec. 32, T. 78 N., R. 11 W.	Kansan glacial	10438	0 to 7	A1	104	17

samples taken from nine soil profiles

procedures of the American Association of State Highway Officials (AASHO) (*1*)]

Mechanical analysis [2]												Liquid limit	Plasticity index	Classification	
Percentage passing sieve—								Percentage smaller than—						AASHO	Unified [3]
1-in.	¾-in.	⅜-in.	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 60 (0.25 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.005 mm.	0.002 mm.	0.001 mm.				
------	------	------	------	------	100	99	98	92	28	19	15	44	17	A-7-6(12)	ML-CL.
------	------	------	------	------	------	------	100	96	39	32	29	43	21	A-7-6(13)	CL.
------	------	------	------	------	100	99	98	94	36	26	22	39	18	A-6(11)	CL.
------	------	------	------	------	------	100	99	91	30	16	10	32	8	A-4(8)	ML-CL.
------	------	------	------	------	------	------	100	93	40	31	27	47	24	A-7-6(15)	CL.
------	------	------	------	------	------	------	100	92	33	27	21	42	21	A-7-6(13)	CL.
------	------	------	------	100	99	98	97	88	26	17	11	43	13	A-7-5(10)	ML.
------	------	------	------	------	------	100	99	93	36	31	27	43	20	A-7-6(13)	CL.
------	------	------	------	------	100	99	97	92	31	23	17	34	15	A-6(10)	CL.
------	------	------	100	99	90	79	51	39	13	8	5	31	7	A-4(3)	ML-CL.
100	99	99	99	98	89	79	57	49	31	26	23	36	18	A-6(8)	CL.
100	99	98	98	96	86	75	52	45	24	19	15	30	16	A-6(6)	CL.
------	------	------	------	------	------	100	99	93	38	25	18	45	18	A-7-6(12)	ML-CL.
------	------	------	------	------	------	100	99	95	46	37	31	53	26	A-7-6(17)	MH-CH.
------	------	------	------	------	------	100	99	93	33	27	21	43	23	A-7-6(14)	CL.
------	------	------	------	------	------	100	94	85	28	20	16	38	14	A-6(10)	ML-CL.
------	------	------	------	------	------	100	99	93	37	27	20	43	16	A-7-6(11)	CL.
------	------	------	------	------	------	100	99	94	43	34	20	48	23	A-7-6(15)	CL.

because more acreage can be used for rotation grazing. Farm ponds also furnish supplemental water for livestock during extended dry periods when many wells in the county go dry. Most soils in the county provide suitable sites for ponds.

Most farm ponds in the county are constructed in rolling soils derived from glacial till or in soils derived from alluvium. Watertight ponds can be constructed in most places by excavating a core trench through the highly organic topsoil and backfilling with more impervious glacial material. Strata or pockets of sand occur in places in the glacial till and in old alluvium along waterways. Because this coarse-textured material presents special problems, each site needs to be thoroughly investigated.

Farm ponds are of primary importance in soil associations 2 and 6. The soils in these associations generally are well suited to ponds, and nearly every farm has good available sites. Ponds are also needed in soil association 7, but the soils as a whole are more permeable than those in associations 2 and 6. Thus, deep soil borings should be made on each prospective site. In soil association 5, many of the soils are too porous to hold water. The Chelsea, Hagener, and Dickinson soils, for example, generally do

Irrigation.—The opportunity for irrigated farming is limited in Iowa County because the flow of streams is small, adequate wells generally are not available, and reservoirs commonly are not practical. Reservoirs would be expensive to build and would be difficult to maintain because of high rate of sedimentation. Table 5 shows the suitability of the soils for irrigation if water is available.

Genesis, Classification, and Morphology of the Soils

This section presents the outstanding morphologic characteristics of the soils of Iowa County and relates them to

on the surface in Iowa County. The Kansan drift is identifiable throughout the county, and on steep slopes it forms an extensive part of the landscape (*12*). Glacial till is the dominant lithologic unit and is composed of coarse fragments in a loam to clay loam matrix. The lower part, which is dark gray and calcareous, contains limestone and dolomite particles and is the unoxidized and unleached zone. Above this zone is yellowish-brown till that is calcareous, and above this is yellowish-brown till that is noncalcareous.

Soils developed on the Kansan till plain during the Yarmouth and Sangamon interglacial ages. This was before the loess was deposited. In nearly level areas, the soils were strongly weathered and had a gray plastic

The Bassett and Kenyon soils are the major soils in Iowa

Where sediments have accumulated at the foot of the slope silty in texture rather than sandy. Eolian sand consists largely of quartz, which is resistant to weathering and has not been altered appreciably since being deposited. The Hagener and Chelsea soils developed in eolian sand and can be distinguished from other soils by their high uniform content of fine sand and very fine sand and their low content of clay.

Climate

Available evidence suggests that in Iowa County the soils have been developing under the influence of midcontinental, subhumid climate for at least 5,000 years. Between 5,000 and 16,000 years ago, the climate was conducive to forest vegetation (*12*). The morphology of most soils of Iowa County indicates that the soils developed in a climate similar to the present climate.

The influence of the general climate of the region is modified by local conditions in or near the developing soil. For example, south-facing dry sandy slopes have a microclimate that is warmer and less humid than the average

zolic soils in Iowa County. The blanched silt and sand grains are very noticeable when dry. These morphological differences were noticed both in soils on uplands and on terraces, but a complete morphological study was not made at this time.

Relief

Relief is an important cause of difference among soils. Indirectly, it influences soil development through its effect on drainage. In Iowa County, the relief ranges from level to steep. Many nearly level areas are frequently flooded and have a high or periodically high water table. In nearly level areas and depressions that are not subject to flooding, water soaks in. On stronger slopes, much of the rainfall runs off.

In general, the soils in Iowa County that formed under a high or periodically high water table have a dominantly olive-gray subsoil, such as that of the Taintor, Zook, and Wabash soils. Those that developed where the water table was below the subsoil have a yellowish-brown subsoil like

The loess that covers much of Iowa County, and from which the Otley, Tama, Downs, Fayette, Clinton, and related soils developed, is probably 14,000 to 16,000 years old, the maximum age for these soils (*13*).

Man's influence on the soil

Important changes take place in the soil when it is cultivated. Some of these changes have little effect on soil productivity; others have drastic effects.

Changes caused by water erosion generally are the most apparent. On many of the cultivated soils in the county, particularly those on gently rolling to hilly slopes, part or all of the original surface layer has been lost through sheet erosion. In some places shallow to deep gullies have

depth of the solum, which is fairly uniform in soils on the undulating and rolling uplands. In many profiles, the effect of plant and animal life is denoted by a deep, dark-colored A horizon. The nature of the parent material is apparent in the silty character of the soils, most of which formed from loess.

In Iowa County, soil morphology is indicated by faint to prominent horizons. Examples of soils with prominent horizons are the Chariton, Clinton, Lindley, Adair, and Sperry. Soils with little horizonation (faint horizons) are the Nodaway, Colo, Hopper, and Hagener.

Soil horizons developed as the result of one or more of the following processes: (1) accumulation of organic matter, (2) leaching of calcium carbonate and bases, only apparent difference between the upper and lower C horizons in these soils is in the presence of calcium carbonates.

Classification of Soils

Soils with certain fundamental characteristics in common are grouped together for the purpose of comparing soils of a particular county with soils elsewhere (*24, 25*). The soils of Iowa County have been grouped according to two classification systems—the 1938–1949 System, and the current Comprehensive System or 7th Approximation. Table 7 shows the great soil groups that are represented in Iowa County, under both classification systems. Under the 1938–1949 System, some soils have been classified in one group but are intergrading toward another great soil group. Placement of some soil series in the current system of classification, particularly in families, may change as more precise information becomes available.

Following is a description of the great soil groups of the 1938–1949 System that are represented in Iowa County.

Brunizems.—Brunizems (Prairie soils) are a zonal group that developed under tall grasses, in a temperate relatively humid climate (*22*). They have a thick (10 to 20 inches), dark-colored A1 horizon; a thick (15 to 24 inches), dark-brown to dark yellowish-brown B horizon; and a yellowish-brown C horizon, which in places contains grayish mottles. They have moderately strong horizon differentiation, as evidenced by a gradual decrease in content of organic matter from the surface to the subsoil. The principal textures are silty clay loam or silt loam in the A horizon; clay loam or silty clay loam in the B horizon; and light clay loam or silt loam in the C horizon. Some Brunizems are sandy. In these, the B horizon commonly is finer textured than the A or C horizon, and horizonation is weak and indistinct. In many places iron-clay bands occur in the lower part of the B horizon or in the C horizon. These bands are from ¼ to 1 inch thick and contain 3 or 4 percent more clay than the material on either side. Brunizems typically are moderately acid, with a gradual increase in pH in the lower part of the B horizon and in the C horizon. The Tama and Otley soils are good examples of Brunizems.

The encroachment of deciduous trees on the prairie has been related to changing climatic conditions (*9*). With the advance of trees, the Brunizem soil is converted into a transitional soil, with morphological characteristics intermediate to associated Gray-Brown Podzolic soils. Some soil profiles in the county suggest that the reverse cycle occurred; that is, prairie grasses invaded the forest. However, there is no conclusive evidence that this is a

have a thicker A1 horizon and a darker colored B horizon. In contrast to Gray-Brown Podzolic soils, the Humic Gley soils have a much thicker, darker colored A1 horizon, lack an A2 horizon, and have a darker colored B horizon. They differ from the Planosols in having a thicker A1 horizon and in lacking an A2 horizon. The Bremer, Colo, Taintor, Wabash, and Zook soils represent the Humic Gley great soil group in Iowa County.

Gray-Brown Podzolic soils.—Gray-Brown Podzolic soils, which belong to the zonal order, are the forested counterpart of the Brunizems. They developed primarily under an oak-hickory type of forest. These soils have a relatively thin A1 horizon, which is from 3 to 7 inches thick; a dark grayish-brown to light brownish-gray, acid A2 horizon, which has thin, platy structure; and a dark yellowish-brown to yellowish-brown B horizon, which is from 15 to 30 inches thick. Gray-Brown Podzolic soils are moderately acid throughout the solum and have an accumulation of silicate clay in the B horizon. The Clinton and Fayette soils are typical examples of this great soil group.

Planosols.—Planosols belong to the intrazonal order. These soils have one or more horizons abruptly separated from and sharply contrasting to an adjacent horizon as a result of cementation, compaction, or high content of clay. They developed under forest, marsh grasses, and sedges or under marsh grasses and sedges that were invaded by forest, under poor or very poor drainage conditions. Planosols have a distinctly developed, bleached and leached A2 horizon, and a strongly developed, genetic clayey B horizon, which is commonly called a claypan. The B horizon is silty clay loam to silty clay and has weak to moderate blocky structure. It restricts the movement of water because of the high content of clay. The Sperry, Walford, Coppock, and Chariton soils are examples of Planosols in Iowa County.

Alluvial soils.—The soils of this great soil group occupy flood plains or first bottoms along streams and are subject to flooding. They are developing from relatively recent deposits of alluvium and lack the distinct horizons that are evident in soils of other great soil groups. Each time they are flooded, they receive fresh deposits of alluvial material. The different soil layers commonly reflect the flood history of the soils. The Nodaway soils are an example of this group.

Technical Descriptions of the Soil Series

This section is provided for those who need more detailed information about the soils in Iowa County. A narrative profile description of one soil type is followed

TABLE 7.—*Classification of the soil series according to the 1938–1949 System and the Comprehensive System, 7th Approximation*

Soil series	1938–1949 System	Comprehensive System, 7th Approximation	
	Great soil group	Family	Subgroup
Adair	Brunizem	Fine, montmorillonitic, mesic	Aquic Argiudoll.
Amana	Brunizem intergrading to Gray-Brown Podzolic.	Fine silty, mixed, mesic	Aquic Hapludoll.
Atterberry	Gray-Brown Podzolic intergrading to Brunizem.	Fine silty, mixed, mesic	Aquollic Normudalf.
Bassett	Gray-Brown Podzolic intergrading to Brunizem.	Fine loamy, mixed, mesic	Mollic Normudalf.
Bertrand	Gray-Brown Podzolic	Fine silty, mixed, mesic	Typic Normudalf.

Keswick soils in that they have a darker colored A1 horizon and lack an A2 horizon.

In Iowa County, a thin-solum phase is recognized. This phase has a reddish mottled clay layer, less than 12 inches thick, in the B horizon. Adair clay loam, thin solum, is less permeable than the Shelby soils, which lack the reddish mottled clay layer.

dark grayish brown (10YR 3/2). The A horizon ranges from clay loam to silt loam. In places, near loess-derived soils that occur upslope, it is silt loam. The B horizon ranges from clay to heavy clay loam and contains fine gravel and a few pebble-sized igneous rocks. Textural analyses indicate that the Adair soils have a maximum clay content in the B horizon of about 40 to 55 percent.

fine, faint, yellowish-brown (10YR 5/4) and olive-brown (2.5Y 4/4) mottles, and few, fine, distinct, strong-brown (7.5YR 5/6) mottles; thin, patchy clay films; gray (10YR 6/1, dry) silt grains on ped surfaces; many fine tubular pores; medium acid; gradual, smooth boundary.

B22—35 to 48 inches, light silty clay loam; grayish brown (2.5Y 5/2) on exterior of peds, and dark grayish brown (2.5Y 4/2) on interior of peds; kneads to grayish brown (2.5Y 5/2) to dark grayish brown (2.5Y 4/2); friable; moderate, medium, subangular blocky structure; common, fine, distinct, dark yellowish-brown (10YR 4/4) and yellowish-brown (10YR 5/4) mottles; few fine concretions of black oxide; gray (10YR 6/1, dry) silt grains on ped surfaces; common fine tubular pores; medium acid; gradual, smooth boundary.

B3—48 to 62 inches, gray (5Y 5/1) heavy silt loam; kneads to grayish brown (10YR 5/2 to 2.5Y 5/2); friable; massive with some vertical cleavage; many, fine, distinct, yellowish-brown (10YR 5/6) and strong-brown (7.5YR 5/6) mottles; common concretions of black oxide;

The Atterberry soils are the somewhat poorly drained members of the toposequence that includes the well-drained Downs soils and the poorly drained Walford soils. They are the prairie-forest formed members of the biosequence that includes the prairie-formed Muscatine soils and the forest-formed Stronghurst soils.

Profile of Atterberry silt loam, 80 feet north and 530 feet east of the SW. corner of sec. 5, T. 80 N., R. 12 W., in a meadow, on a nearly level tabular divide.

Ap—0 to 7 inches, black (10YR 2/1) to very dark gray (10YR 3/1) silt loam; kneads to very dark gray (10YR 3/1); friable; clods break to weak, medium, granular structure; few, fine, distinct, gray (10YR 6/1) mottles; neutral; clear, smooth boundary.

A2—7 to 13 inches, 40 percent gray (10YR 6/1) and 60 percent dark-gray (10YR 4/1) silt loam; friable; weak, thin, platy structure breaks to moderate, very fine, subangular blocky structure; few, fine, faint soft concretions of dark-brown to brown (10YR 4/3) oxide; common fine tubular pores; neutral; clear, smooth commonly increases with depth. In most places, a silt

IIB32—38 to 47 inches, light clay loam to loam; gray (5Y 5/1) few very dark gray (10YR 3/1) worm casts; few fine tubular pores; slightly acid; clear, smooth boundary.

B1—10 to 16 inches, dark-brown (10YR 4/3) heavy silt loam; kneads to yellowish brown (10YR 5/4); friable; weak, fine, subangular blocky structure; few very coarse sand grains, 1 to 2 millimeters in size; medium acid; gradual, smooth boundary.

B2—16 to 33 inches, yellowish-brown (10YR 5/4) light silty clay loam; friable; moderate, medium and fine, subangular blocky structure; few very coarse sand grains, 1 to 2 millimeters in size; gray (10YR 6/1, dry) silt grains on peds; few, thin, patchy, clay films; few concretions of black oxide; strongly acid; gradual, smooth boundary.

B3—33 to 42 inches, yellowish-brown (10YR 5/4) heavy silt

A3—13 to 21 inches, black (N 2/0 to 10YR 2/1) medium silty clay loam; firm; moderate, very fine, subangular blocky structure; some ped coatings; slightly acid; gradual, smooth boundary.

B21g—21 to 28 inches, dark-gray (5Y 4/1) heavy silty clay loam to light silty clay; firm; moderate, fine, subangular blocky structure; few, fine, prominent, yellowish-brown (10YR 5/6) and strong-brown (7.5YR 5/6) mottles; thin continuous clay films; slightly acid; gradual, smooth boundary.

B22g—28 to 35 inches, dark-gray (5Y 4/1) medium silty clay loam; firm; moderate, medium, subangular blocky structure; common, fine, prominent, yellowish-brown (10YR 5/6) mottles; thin continuous clay films; slightly acid; gradual, smooth boundary.

platy structure; medium acid; abrupt, smooth boundary.

B21—25 to 35 inches, black (10YR 2/1) heavy silty clay loam to light silty clay; kneads to very dark gray (10YR 3/1); firm; moderate, fine, prismatic structure breaks to strong, fine, subangular blocky structure; thick continuous clay films; medium acid; clear, smooth boundary.

B22g—35 to 41 inches, very dark gray (5Y 3/1) to dark-gray (5Y 4/1), heavy silty clay loam to light silty clay; very firm; moderate, fine, subangular blocky structure; few, fine, distinct, dark yellowish-brown mottles; thick continuous clay films; slightly acid; gradual, smooth boundary.

B3g—41 to 50 inches, mottled dark-gray (5Y 4/1) and yellowish-brown (10YR 5/6) medium silty clay loam; firm; some vertical cleavage; slightly acid.

The A1 horizon commonly is black (10YR 2/1) or very dark gray (10YR 3/1) but may have a very dark brown (10YR 2/2) or very dark grayish-brown (10YR 3/2) overwash on the surface. If there is no overwash, the A1 horizon commonly varies between 8 and 10 inches in thickness. The A2 horizon ranges from 6 to 12 inches in thickness and generally is dark gray (10YR 4/1) but in places ranges to gray (10YR 5/1) or grayish brown (10YR 5/2). The B2 horizon is heavy silty clay loam to light silty clay. It ranges from black (10YR 2/1) or very dark gray (10YR 3/1) to dark gray (10YR 4/1) with depth.

Chelsea Series. The Chelsea series consists of coarse-textured soils that developed in noncalcareous material composed largely of fine and medium sand, which is predominantly quartz. These soils are classified as Gray-Brown Podzolic soils that are intergrading toward Regosols (Psammentic Normudalfs). They occur in a complex pattern on uplands near the Iowa River. The slope ranges from 2 to 40 percent. The native vegetation was trees.

The Chelsea soils have a dark grayish-brown, loose fine sand A horizon that is from 3 to 5 inches thick. They have a weakly developed, discontinuous B horizon consisting of thin, dark-brown horizontal bands of loamy fine sand. These bands occur between a depth of 2 and 4 feet and are redder and contain a little more clay than the interbands. The C horizon is yellowish-brown, loose fine sand. The reaction is strongly acid or medium acid.

The Chelsea soils are coarser textured and have a higher content of sand in the uppermost 3 feet than the Lamont soils. They are similar to the Hagener soils in texture but have a thinner A horizon and generally are more acid. In Iowa County, they commonly occur in association with the Fayette and Lamont soils and have been mapped as a Chelsea-Fayette-Lamont complex.

Profile of Chelsea fine sand, 200 feet south along TV

B13—22 to 34 inches, yellowish-brown (10YR 5/4) fine sand; loose; single grain; strongly acid; gradual, smooth boundary; a 2-inch continuous band of dark-brown (7.5YR 4/4) loamy fine sand with weak, medium, subangular blocky structure occurs at a depth of 25 inches.

C1—34 to 44 inches, yellowish-brown (10YR 5/6) fine sand; loose; incoherent; single grain; occasional roots; dark-brown (7.5YR 4/4) wavy discontinuous bands up to ½ inch thick occur in this horizon; medium acid; gradual, smooth boundary.

C2—44 to 73 inches, brownish-yellow (10YR 6/6) fine sand; loose; incoherent; single grain; dark-brown (7.5YR 4/4) wavy discontinuous bands up to ½ inch thick occur in this horizon; medium acid.

The thickness and color of the A and Ap horizons vary considerably because the surface layer is susceptible to shifting both by wind and by rodents. The A horizon ranges from fine sand to loamy fine sand. In most places the depth to the bands of redder hue is 2 to 4 feet. The bands are typically loamy sand and are wavy and discontinuous. They commonly are ½ inch or less in thickness.

Clinton Series. The Clinton series consists of moderately well drained, Gray-Brown Podzolic soils (Typic Normudalfs) derived from loess. The slope ranges from 2 to 25 percent. Figure 8, page 7, shows the relationship of these soils to other soils in the county. The native vegetation consisted mainly of trees.

The Clinton soils have a very dark gray silt loam A1 horizon; a distinct grayish-brown to dark grayish-brown silt loam A2 horizon; a dark yellowish-brown, firm heavy silty clay loam B horizon in which there are distinct silt coats; and a light yellowish-brown silt loam C horizon. In cultivated areas, where the A2 is lacking, the Ap horizon is typically dark grayish brown.

These soils differ from the somewhat poorly drained Keomah soils in that their A2 horizon commonly is less distinct, and their B horizon has a chroma of 3 or higher and is not mottled at less than 30 inches from the surface. The Clinton soils have more clay in the B horizon than the Fayette soils and generally are more acid throughout the solum. They have a thinner, lighter colored A1 horizon and a more distinct A2 horizon than the closely associated Ladoga soils.

The Clinton soils are the forest-derived soils in the Otley, Ladoga, Clinton biosequence.

Profile of Clinton silt loam, 640 feet east and 50 feet north of the SW. corner of the SE¼ sec. 23, T. 79 N., R. 12 W., on a 7 percent convex slope, in a bluegrass pasture.

Ap—0 to 6 inches, very dark gray (10YR 3/1) silt loam; gray (10YR 5/1) when dry; friable; strong, fine, granular structure; few, weak, thin plates; slightly acid; clear, smooth boundary.

subangular blocky structure; light-gray (10YR 7/1, dry) silt grains on peds; few black oxide stains on peds; common thin clay films on many peds; medium acid; gradual, smooth boundary.

B3—38 to 54 inches, light yellowish-brown (10YR 6/4) medium to light silty clay loam; firm; weak, coarse, subangular blocky structure; light-gray (10YR 7/1, dry)

B2—36 to 43 inches, black (N 2/0) medium silty clay loam; firm; moderate, fine, prismatic structure; slightly acid; gradual, smooth boundary.

B3g—43 to 50 inches, very dark gray (N 3/0) light silty clay loam; friable to firm; weak, medium, prismatic structure; slightly acid; gradual, smooth boundary.

Cg—50 to 60 inches, gray to grayish-brown (2.5Y 5/1) light few fine tubular pores; medium acid; gradual, smooth boundary.

B3—35 to 49 inches, gray (10YR 5/1) light or medium silty clay loam; kneads to brown (10YR 4/3) to olive brown (2.5Y 4/4); friable to firm; weak, coarse, prismatic structure breaks to weak, coarse, subangular blocky structure; common, fine, distinct, yellowish-brown (10YR 5/6) and dark-brown to brown (7.5YR 4/4) mottles; few fine concretions of dark reddish-brown (5YR 2/2) oxide; few fine tubular pores; medium acid; gradual, smooth boundary.

C—49 to 62 inches, mixed gray (10YR 5/1) and yellowish-brown (10YR 5/4) light silty clay loam; kneads to brown (10YR 5/3); friable to firm; massive with vertical cleavage; common fine concretions of black oxide and black oxide stains on vertical faces; slightly acid.

The A1 horizon ranges from 5 to 10 inches in thickness and from very dark gray (10YR 3/1) to very dark brown (10YR 2/2) in color. The A2 horizon ranges from 10 to 30 inches in thickness and in places has a few or common mottles. The clay maximum in the B horizon ranges from 30 to 36 percent. The depth to clay maximum is typically between 24 to 30 inches but ranges to as much as 40 inches.

Dickinson Series. The Dickinson series consists of well-drained or somewhat excessively drained Brunizems (Typic Hapludolls) that developed from moderately coarse textured materials. These soils occur on benches and uplands that parallel the Iowa River. The slope ranges from 0 to 9 percent. The native vegetation was prairie grasses.

These soils have a very dark brown, very friable sandy loam A horizon; a weakly defined, dark-brown to yellowish-brown, very friable sandy loam to loam B horizon; and a yellowish-brown loamy sand or sand C horizon. They typically are acid in the B horizon.

The Dickinson soils have sandy loam A and B horizons that are more retentive of moisture than the fine sand A and B horizons of the Hagener soils. They have coarser textured A and B horizons than the Waukegan soils.

Profile of Dickinson sandy loam, 550 feet south and 780

ranges to loam. In places fine sand occurs between 20 and 36 inches, and on some benches stratified layers of loam and fine sand occur below a depth of 36 inches.

Dinsdale Series. The Dinsdale series consists of well-drained Brunizems (Typic Argiudolls) that developed from 20 to 40 inches of loess over loam glacial till. These soils occur on gentle convex slopes on the uplands of the loess-mantled glacial till plain. The slope ranges from 2 to 9 percent. The A horizon and the upper part of the B horizon developed in loess, and the lower part of the B horizon and the C horizon developed in friable to firm glacial till. In places there is a layer of sandy sediments, several inches thick, immediately above the till. The native vegetation was prairie grasses.

The A horizon is very dark brown, friable light silty clay loam; the upper part of the B horizon is dark-brown friable silty clay loam; and the lower part of the B horizon and the C horizon are brown to yellowish-brown, friable to firm loam.

The Dinsdale soils have a thicker, darker colored A1 horizon than the Waubeek soils and generally have darker colored coatings in the B horizon. They differ from the Waukegan soils in having loam glacial till between a depth of 20 and 40 inches instead of sand, and they differ from the Kenyon soils in that they are more silty and less sandy in the A horizon and upper part of the B horizon. The Dinsdale soils that developed in 20 inches of loess are similar to the Kenyon soils, and the Dinsdale soils that developed in 40 inches of loess are similar to the Tama soils.

Profile of Dinsdale silty clay loam, 515 feet east and 45 feet south of the NW. corner of sec. 2, T. 81 N., R. 9 W., on a 3 percent convex slope in a meadow.

Ap—0 to 7 inches, black (10YR 2/1) light silty clay loam; kneads to very dark brown (10YR 2/2); friable; clods break to weak, fine, granular structure; slightly acid; abrupt, smooth boundary.

A12—7 to 12 inches, very dark brown (10YR 2/2) light silty clay loam; kneads to very dark grayish brown (10YR 3/2); friable; moderate medium and fine

6/1) loam; kneads to yellowish brown (10YR 5/4) to dark yellowish brown (10YR 4/4); friable to firm; some pebbles; weak, coarse, subangular blocky structure; few, fine, prominent yellowish-brown (10YR 5/8) and strong-brown (7.5YR 5/6) mottles; thin discontinuous clay films; few concretions of yellowish-

T. 81 N., R. 12 W., on a 3 percent convex slope, in a bluegrass pasture in which there are some scattered trees.

A1—0 to 7 inches, very dark gray (10YR 3/1) silt loam; kneads to very dark grayish brown (10YR 3/2); friable; weak, thin, platy structure; numerous fine brown, mottled, friable light silty clay loam B horizon that is moderately permeable. In most places they are leached below a depth of 50 inches.

These soils differ from the Judson soils in that they are mottled and have colors of lower chroma in the B horizon.

Fayette Series. The Fayette series consists of well-drained Gray-Brown Podzolic soils (Typic Normudalfs) that developed from loess. These soils occur principally in the northern third of the county, on slopes of 2 to 40 percent. Figure 5, page 5, shows their relationship to gray (10YR 7/1, dry) silt grains on vertical faces; slightly acid.

The A1 horizon ranges from very dark gray (10YR 3/1) to dark gray (10YR 4/1) in color and from 2 to 4 inches in thickness. The A2 horizon ranges from dark grayish brown (10YR 4/2) to grayish brown (10YR 5/2) and is from 4 to 8 inches thick. In cultivated areas, it commonly is mixed with the plow layer. The Ap horizon generally is very dark grayish brown (10YR 3/2) to grayish brown (10YR 4/2). The B2 horizon has a clay maximum of less than 35 percent and ranges from light to medium silty clay loam. Some gray mottles occur in places below a depth of 30 inches in the lower part of the B horizon and in the C horizon, but these are considered to be relict. Base saturation and pH increase with depth in the C horizon.

GARA SERIES. The Gara series consists of moderately well drained soils that developed from clay loam glacial till. These soils are classified as Gray-Brown Podzolic soils that are intergrading toward Brunizems (Mollic Normudalfs). They occur on slopes of 5 to 25 percent and are downslope from the Ladoga or Clinton soils but upslope from soils in drainageways. The largest acreage is in the southern half of the county. Figure 8, page 7, shows their relationship to associated soils. The native vegetation consisted of prairie grasses and trees.

The Gara soils have a very dark gray, friable loam A1 horizon; a brown to yellowish-brown, friable to firm light

pebbles and stones; strongly acid; gradual, smooth boundary.

B3—30 to 47 inches, yellowish-brown (10YR 5/4) light clay loam; friable to firm; weak, medium and coarse, subangular blocky structure; few, fine, faint, yellowish-brown (10YR 5/8) mottles; gray (10YR 5/1) silt grains on peds, when dry; few pebbles and stones; strongly acid; gradual, smooth boundary.

C—47 to 60 inches, yellowish-brown (10YR 5/6) loam; kneads to yellowish brown (10YR 5/4); friable to firm; massive; common, fine, distinct, strong-brown (7.5YR 5/8), and grayish-brown (10YR 5/2) mottles; few concretions of black oxide; few pebbles and stones; neutral.

The A1 horizon is typically very dark gray (10YR 3/1) and is from 4 to 8 inches thick. In most areas the A horizon is loam, but in uneroded areas, near loess soils upslope, it commonly is gritty silt loam. Generally, the A2 horizon is from 2 to 4 inches thick and is weakly developed. In cultivated areas, it commonly is lacking. The B horizon has a maximum clay content of about 34 to 40 percent and is from 24 to 36 inches thick. The degree of mottling increases with depth below the B1 horizon. Mottles typically are strong brown, yellowish brown, grayish brown, and gray to olive gray. The reaction is strongly acid or medium acid in the most acid part of the solum.

GIVIN SERIES. The Givin series consists of somewhat poorly drained soils derived from loess. These soils are classified as Gray-Brown Podzolic soils that are intergrading toward Brunizems (Aquollic Normudalfs).

to moderate, medium, subangular blocky structure; common, fine, distinct, dark yellowish-brown (10YR 4/4) mottles; grayish-brown (10YR 5/2) ped coatings which are light brownish gray (10YR 6/2) to white (10YR 8/1) when dry; thin, continuous, clay films; medium acid; gradual, smooth boundary.

B31—27 to 42 inches, grayish-brown (2.5Y 5/2) medium silty clay loam; firm; moderate, medium, prismatic structure breaks to weak, medium, angular blocky structure; thin continuous clay films; ped coatings of dark gray (10YR 4/1) and dark grayish brown (10YR 4/2); common, fine, distinct, dark yellowish-brown mottles; medium acid; gradual, smooth boundary.

B32—42 to 50 inches, grayish-brown (2.5Y 5/2) light silty clay loam; kneads to olive brown (2.5Y 4/4); friable; weak, coarse, prismatic structure breaks to weak, coarse, angular blocky structure; many, medium, distinct, strong-brown (7.5YR 5/6) mottles and few, fine, distinct, yellowish-brown (10YR 5/8) mottles; medium acid.

The A1 horizon ranges from black (10YR 2/1) to very dark gray (10YR 3/1) in color and from 4 to 8 inches in thickness. In most places the A2 horizon ranges from dark gray (10YR 4/1) to dark grayish brown (10YR 4/2) in color and from 3 to 6 inches in thickness. The hue of the B horizon is 10YR to 2.5Y, and the color value is 4 in the upper part and grades to 5 in the lower part. The chroma generally is 2. The clay maximum ranges from medium to heavy silty clay loam. Mottles are evident below the A horizon and increase in size and abundance tional between the A and C horizons. In some places the color value is 3 to a depth of 30 inches. Thin bands of strong-brown clay and iron occur at a depth below 3 feet in some areas. These bands are a few percent higher in content of clay than the interbands.

Hopper Series. The Hopper series consists of well-drained soils that formed from coarse, calcareous loess that contains about 10 to 20 percent of very fine sand. These soils are classified as Gray-Brown Podzolic soils that are intergrading toward Regosols (Dystric Eutrochrepts). They occur on long narrow ridges on the south side of the Iowa River, in Hilton and Lenox Townships. These ridges are oriented in a northwesterly to southeasterly direction and are known as pahas. The native vegetation was mainly trees.

The Hopper soils have a dark grayish-brown, very friable silt loam A horizon; a weakly defined, yellowish-brown, friable silt loam B horizon that has little structural development; and a yellowish-brown, friable silt loam C horizon that is neutral or mildly alkaline.

These soils differ from the Fayette soils in that they have less clay in the A and B horizons, have little or no structural development in the B horizon, and are less acid throughout the profile.

Profile of Hopper silt loam, 180 feet south and 870 feet east of the NW. corner of the NE¼NW¼ sec. 11, T. 81

4/2) to grayish brown (10YR 5/2) in color and from 4

structure; many, fine, distinct, yellowish-brown (10YR 5/8) and strong-brown (7.5YR 5/8) mottles; light-gray (10YR 6/1) ped coatings when dry; common concretions of iron and manganese; thin discontinuous clay films; strongly acid; diffuse, smooth boundary.

C—53 to 63 inches, grayish-brown (10YR 5/2) heavy silt loam to light silty clay loam; kneads to light yellowish

(7.5YR 4/4); friable to firm; some pebbles; moderate, medium and fine, subangular and angular blocky structure; few, fine, distinct, yellowish-red (5YR 4/6) mottles; few distinct gray (10YR 6/1) silt grains on ped surfaces, when dry; thin nearly continuous clay films; medium acid; gradual, smooth boundary.

IIB22—19 to 25 inches, yellowish-red (5YR 5/6) heavy clay

The Koszta soils differ from the Amana soils in having a thinner A1 horizon and a dark grayish-brown A2 horizon. They differ from the Nevin soils in having a thinner A1 horizon, an A2 horizon, distinct silt coats on peds in the B horizon, and a more acid solum. The A2 horizon of the Koszta soils is thinner and less discernible than that of the Coppock soils, and generally their B horizon is not so fine textured. Their B3 and C horizons commonly are firmer and higher in content of clay than those of the Atterberry soils.

The Koszta soils are the prairie-forest members of the biosequence that includes the prairie-formed Nevin soils.

Profile of Koszta silt loam, 780 feet west and 770 feet south of the NE. corner fence post, in sec. 12, T. 78 N., R. 11 W.

Ap—0 to 9 inches, very dark brown (10YR 2/2) heavy silt loam; clods break to weak, fine, granular structure; friable to firm; neutral; abrupt, smooth boundary.

A2—9 to 14 inches, very dark grayish-brown (10YR 3/2) to dark grayish-brown (10YR 4/2) silt loam; 10 percent very dark gray (10YR 3/1) coats on plates; kneads to dark grayish brown (10YR 4/2); moderate, thin, platy structure breaks to weak, fine, granular structure; friable; few, fine, faint, dark yellowish-brown (10YR 3/4) mottles; few fine concretions of strong-brown (7.5YR 5/6) oxide; medium acid; clear, smooth boundary.

B1—14 to 23 inches, grayish-brown (10YR 5/2) light silty clay loam; ped exteriors have slightly lower value; kneads to grayish brown (10YR 5/2); friable; moderate, fine, subangular blocky structure; common, fine, district, yellowish-brown (10YR 5/6) mottles; few, fine, soft concretions of strong-brown (7.5YR 5/6) oxide; few fine tubular pores; medium acid; gradual, smooth boundary.

B21—23 to 29 inches, grayish-brown (2.5Y 5/2) light silty clay loam; kneads to grayish brown (10YR 5/2); weak, fine, prismatic structure breaks to moderate, fine, subangular blocky structure; friable; common, fine, distinct, yellowish-brown (10YR 5/6) mottles; few, fine, hard concretions of black oxide; light-gray (10YR 7/1) silt grains on peds when dry; many fine tubular pores; strongly acid; gradual, smooth boundary.

B22—29 to 41 inches, medium silty clay loam; gray to light-gray (5Y 6/1) exterior coats mainly on prism faces; interior is mixed 60 percent gray to light gray (5Y 6/1) and 40 percent yellowish brown (10YR 5/6); kneads to grayish brown to light olive brown (2.5Y 5/3); moderate, medium, prismatic structure breaks to moderate, medium, subangular blocky structure; friable to firm; few, fine, distinct, strong-brown (7.5YR 5/6) mottles; few, fine, hard concretions of black oxide; thin discontinuous clay films on prism faces; light-gray (10YR 7/1) silt grains mainly on

horizon ranges from 4 to 10 inches in thickness and the upper part commonly is grayish brown (10YR 4/2) to very dark grayish brown (10YR 3/2). The B horizon is light or medium silty clay loam. It has hues of 10YR to 2.5Y, when moist, values of 4 or 5, and a chroma of 2 that grades to 1 with depth. The chroma of 1 in the upper part of the B horizon is an exterior color and is due to the presence of grainy silt coats.

Ladoga Series. The Ladoga series consists of moderately well drained Gray-Brown Podzolic soils that are intergrading toward Brunizems (Mollic Normudalfs). These soils developed from loess that is low in content of sand. They formed under prairie grasses and trees and have moderate or moderately strong horizonation. Figure 3, page 3, shows their relationship to other soils in the county.

The Ladoga soils have a very dark brown, friable silt loam A horizon; an indistinct, very dark grayish-brown to dark grayish-brown A2 horizon; a brown to dark yellowish-brown silty clay loam B horizon that contains a few mottles at or below a depth of 30 inches; and a brown, friable silt loam to silty clay loam C horizon. In some eroded areas, the A2 horizon is lacking, but distinct silt coats are evident in the B horizon.

In uneroded areas, the Ladoga soils differ from the associated Otley soils in that their A1 horizon is thinner and coarser textured and their B2 horizon has angular blocky structure and contains distinct silt coats. They have a thicker, darker colored A1 horizon and a less distinct A2 horizon than the Clinton soils, and they have a higher content of clay in the B and C horizons than the Downs soils. They differ from the Givin soils in that they are less mottled and have a chroma of 3 in the B horizon.

The Ladoga soils form a toposequence with the Givin soils, and they are the transitional members of the Otley-Ladoga-Clinton biosequence.

Profile of Ladoga silt loam, 1,100 feet east and 150 feet north of the SW. corner of the NW¼SW¼ sec. 18, T. 78 N., R. 11 W., on a 2 percent convex slope, in a cultivated field.

Ap—0 to 5 inches, very dark grayish-brown (10YR 3/2) silt loam; grayish brown (10YR 5/2) when dry; friable; weak, fine, granular structure with a few, weak, thin, plates; neutral; abrupt, smooth boundary.

A2&B1—5 to 10 inches, mixed very dark grayish-brown (10YR 3/2) and dark grayish-brown (10YR 4/2) light silty clay loam; kneads to dark grayish brown

B32—44 to 50 inches, brown (10YR 5/3) silt loam to silty clay loam; kneads to dark yellowish brown (10YR 5/4); friable; massive with vertical cleavage; slightly acid.

The A1 horizon ranges from very dark gray (10YR 3/1) to very dark brown (10YR 2/2) in color and from 4 to 8 inches in thickness. In eroded areas, the Ap horizon is very dark grayish brown (10YR 3/2). The A2 horizon ranges from very dark grayish brown (10YR 3/2) to dark grayish brown (10YR 4/2) in color and from 2 to 4 inches in thickness, but it is lacking in some eroded areas. The B2 horizon has a clay maximum of 35 to 40 percent. There generally is less clay in the B horizon near the central part of the county than near the southern part. Color values grade from 3 to 5 with depth, and chromas of 3 are common in the B horizon. Some mottling generally is evident below a depth of 30 inches. Base saturation and pH increase with depth in the C horizon. The solum is medium acid or strongly acid in the most acid part.

Lamont Series. The Lamont series consists of well-drained to excessively drained Gray-Brown Podzolic soils (Typic Normudalfs) that develop from moderately coarse textured eolian deposits of mixed mineralogy but dominantly of quartz. These soils occur in sloping to rolling areas, mainly near the Iowa River, which was a source of their parent material. In Iowa County, the Lamont soils are closely associated with the Chelsea and Fayette soils. They are the Gray-Brown Podzolic analogues of the

C2—50 to 60 inches, mixed reddish-yellow (7.5YR 6/6) and light-gray (10YR 7/1) loamy sand; very friable; thin bands of iron and manganese; single grain; strongly acid.

The A1 horizon ranges from very dark gray or very dark grayish brown (10YR 3/1 or 3/2) to dark gray or dark grayish brown (10YR 4/1 or 4/2) in color and from 3 to 6 inches in thickness. It is dominantly fine sandy loam but in places is sandy loam or loam. The B horizon ranges from dark yellowish brown and yellowish brown (10YR 4/4 and 5/4) to dark brown, brown, and strong brown (7.5YR 4/4, 5/4, and 5/6) in color and from sandy loam to loam in texture. In structure, it typically is weak, medium and coarse, subangular blocky. In places thin bands of clay and iron, less than 2 inches thick, are evident in the lower part of the B horizon or in the C horizon. The material between the bands is similar to that of the C horizon. The Lamont soils are medium acid or strongly acid in the most acid part of the solum. They generally are leached to a depth of 6 feet or more.

Lawler Series. The Lawler series consists of somewhat poorly drained soils that developed from medium-textured alluvial material of moderate depth over fine and medium sands. These soils are classified as Brunizems (Aquic Hapludolls). They occur on nearly level benches along the Iowa River and its tributaries and in a small area on the uplands near Homestead. They are closely associated with the Waukegan and Udolpho soils. The native vege-

B22—33 to 41 inches, dark grayish-brown (10YR 4/2) loam; kneads to brown to dark brown (10YR 4/3) to olive brown (2.5Y 4/4); friable; weak, medium, subangular blocky structure; common, fine, distinct, yellowish-brown (10YR 5/6) and strong-brown (7.5YR 5/6) mottles; few concretions of yellowish-red and black oxide, 1 to 5 millimeters in size; medium acid; gradual, smooth boundary.

IIC1—41 to 52 inches, mixed gray (10YR 5/1) and dark yellowish-brown (10YR 4/4) loose fine sand; kneads to dark brown to brown (10YR 4/3); fine, single grain; few concretions of black oxide, 5 millimeters in size; medium acid; clear, smooth boundary.

IIC2—52 to 58 inches, mixed 60 percent gray (10YR 6/1) and 40 percent yellowish-brown (10YR 5/6) loose fine sand; kneads to brown (10YR 5/3); single grain; few concretions of black oxide, 5 millimeters in size; medium acid; clear, smooth boundary.

IIC3—58 to 75 inches, light-gray (10YR 7/1) loose fine sand; kneads to very pale brown (10YR 7/3); single grain; common, fine, faint, yellowish-brown (10YR 5/8) mottles; medium acid.

The A1 horizon ranges from 12 to 18 inches in thickness, but commonly there is a dark-colored transitional layer from the A1 horizon to the B2 horizon. The A1 horizon is black (10YR 2/1) to very dark brown (10YR 2/2). The A and B horizons are dominantly loam or gritty silt loam and do not contain stones or pebbles. The B horizon has a color value of 4 and a chroma of 2, and it has few or common mottles that increase in number with depth. Fine and medium sand occur at a depth between 30 and 45 inches. The solum is medium or strongly acid in the most acid horizons, and the underlying coarse-textured material is free of carbonates.

Lawson Series. The Lawson series consists of somewhat poorly drained soils that developed in medium-textured alluvium and that have weak horizonation. These soils are classified as Brunizems that are intergrading toward Alluvial soils (Aquic Cumulic Hapludolls). They are adjacent to the main channels along the English River and along Little Bear and Big Bear Creeks. Consequently, they are frequently dissected by old stream meanders and are subject to occasional overflow. The

strong-brown (7.5YR 5/6) mottles; occasional roots; slightly acid; gradual, smooth boundary.

A13—24 to 35 inches, mixed 80 percent very dark gray (10YR 3/1) and 20 percent dark yellowish-brown (10YR 3/4) heavy silt loam; kneads to very dark grayish brown (10YR 3/2); friable; weak, fine and medium, subangular blocky structure; visible sand grains; few, fine, prominent, strong-brown (7.5YR 5/6 to 7.5YR 5/8) mottles; neutral; gradual, smooth boundary.

B1—35 to 46 inches, dark-gray (10YR 4/1) heavy silt loam; kneads to dark gray (10YR 4/1) to dark grayish brown (10YR 4/2); friable; weak, medium, subangular blocky structure; visible sand grains; few, fine, prominent, strong-brown (7.5YR 5/6) mottles; few fine concretions of iron and manganese; dark yellowish-brown (10YR 3/4) stains on ped surfaces; slightly acid; gradual, smooth boundary.

B2—46 to 68 inches, mixed 60 percent gray (10YR 5/1) and 40 percent dark-brown (10YR 3/3) gritty silt loam; kneads to dark grayish brown (10YR 4/2); friable; weak, coarse, prismatic structure breaks to weak, fine, subangular blocky structure; visible sand grains; few, fine, prominent, strong-brown (7.5YR 5/6) mottles; slightly acid; clear, smooth boundary.

IIC—68 to 79 inches, mixed gray (10YR 5/1) and dark-brown (10YR 3/3) sandy loam; kneads to dark grayish brown (10YR 4/2); very friable; massive; slightly acid.

The A1 horizon is black (10YR 2/1), very dark brown (10YR 2/2), or very dark gray (10YR 3/1) and is from 20 to 40 inches thick. The texture is silt loam, but in places the soil material contains from 5 to 20 percent fine sand. The B horizon is silt loam and has color values of 3 and 4 and a chroma of 2. A few mottles are evident in the A12 and A13 horizons and in the B horizon. The solum is neutral or slightly acid.

Lindley Series. The Lindley series consists of moderately well drained Gray-Brown Podzolic soils (Typic Normudalfs) that developed from clay loam glacial till during Wisconsin Age. These soils occur mainly in highly dissected areas adjacent to streams, on uplands that have a gradient of 9 to 40 percent. They are closely associated with the Keswick soils. Figure 8, page 7, shows their relationship to associated soils. The native vegeta-

B1—8 to 15 inches medium clay loam; brown (10YR 4/3 to 10YR 5/3) on interior of peds; firm; some pebbles; many light brownish-gray (10YR 6/2) to light-gray (10YR 7/2), distinct silt coats on peds when dry;

lack the strong gleying and the 5Y hues and 1 chroma in the B horizon that is typical of the Taintor soils.

The Mahaska soils are the somewhat poorly drained members of the toposequence that includes the moderately shows their relationship to associated soils. The native vegetation was prairie grasses.

The Muscatine soils have a black, friable light silty clay loam A horizon; a dark grayish-brown, mottled, friable to firm, light to medium silty clay loam B horizon that contains indistinct, thin clay films; and a gray, mottled silt loam C horizon. The C horizon is leached of carbonates. The solum is typically medium acid.

These soils occupy positions on the landscape similar to those of the Mahaska soils and are in the same drainage class, but their B horizon is not so fine textured The Muscatine soils have a thicker, darker colored A1 horizon and a somewhat darker brown B horizon than the Atterberry soils, and they lack the weakly defined A2 horizon that is typical of these soils. They are similar to the Nevin soils in some characteristics, but they have a lower content of sand throughout the solum; have less fine-textured, more friable B3 and C horizons; and lack the stratified layers of loam or silty clay loam that occur in the lower part of the B horizon and in the C horizon of some Nevin soils.

The Muscatine soils are the somewhat poorly drained

and generally are oriented on vertical faces of peds. The B horizon commonly has hues of 10YR to 2.5Y and a value of 4 that grades to 5 with depth. In the B horizon the chroma is 2 and mottling is common. Gray (5Y 5/1) or olive-gray (5Y 5/2) colors in the C horizon may be related to relict deoxidized loess. Soil reaction is medium acid or slightly acid in the most acid part of the solum. All horizon boundaries are gradual.

NEVIN SERIES. The Nevin series consists of somewhat poorly drained Brunizems (Aquic Hapludolls) that developed from moderately fine textured alluvium on nearly level or gently sloping terraces along the English and Iowa Rivers and their tributaries. These soils may be flooded by runoff from soils upslope during periods of extremely high rainfall. Figure 4, page 4, shows their relationship to other soils in the county. The native vegetation was prairie grasses.

The Nevin soils have a black, friable light silty clay loam A horizon; a dark grayish-brown, mottled medium silty clay loam B horizon in which there are thin discontinuous clay films; and a grayish-brown, firm light to medium silty clay loam C horizon. Mottling increases in con-

5/6) and strong-brown (7.5YR 5/6) mottles; many fine concretions of black oxide; slightly acid; diffuse,

The surface horizon ranges from very dark gray to grayish brown (2.5Y 5/2) in color and is stratified. In some

B21—18 to 24 inches medium to heavy silty clay loam; dark brown to brown (10YR 4/3) on exterior of peds, and dark yellowish brown (10YR 4/4) on interior of peds; kneads to dark yellowish brown (10YR 4/4); friable to firm; moderate, fine, subangular blocky structure; many fine tubular pores in peds; medium acid; gradual, smooth boundary.

B22—24 to 31 inches medium to heavy silty clay loam; brown (10YR 5/3) on exterior of peds, and yellowish brown (10YR 5/4) on interior of peds; kneads to yellowish brown (10YR 5/4); friable to firm; few, fine, faint, strong-brown (7.5YR 5/6) mottles, and few, fine, faint, grayish-brown (10YR 5/2) mottles in lower part of

tinuous clay films; and a yellowish-brown loam to clay loam C horizon that contains some mottles. Pebbles and small stones commonly occur throughout the solum. The reaction generally is medium acid.

The Shelby soils have a thicker A1 horizon than the Gara soils. They lack the A2 horizon that is typical of uneroded Gara and Lindley soils, and they are less acid than those soils and lack distinct silt coats in the B horizon. They differ from the Adair soils in that they have less clay in the B horizon and lack the reddish colors or

The Sperry soils have a black to very dark gray, friable silt loam A1 horizon; a prominent, gray, friable silt loam

The A1 horizon is black (10YR 2/1) to very dark gray (10YR 3/1) and is from 6 to 10 inches thick. The A2 horizons are prominent and are from 6 to 12 inches thick

B22—22 to 37 inches, grayish-brown (2.5Y 5/2) medium silty clay loam; kneads to brown (10YR 5/3); firm, moderate, medium, subangular blocky structure; gray (10YR 6/1) silt coats on peds when dry; common, fine, faint, yellowish-brown (10YR 5/6) mottles; thin continuous clay films; common fine concretions of black oxide; strongly acid; gradual, smooth boundary.

B3—37 to 49 inches, grayish-brown (2.5Y 5/2) light silty clay loam; kneads to brown to dark brown (10YR 4/3) to olive (5Y 5/3); friable to firm; weak, coarse, subangular blocky structure; many, fine, distinct, yellowish-brown (10YR 5/6) and strong-brown (7.5YR 5/8) mottles; few root channels coated with dark gray (10YR 4/1); many concretions of black oxide; thin discontinuous clay films; medium acid; gradual, smooth boundary.

C—49 to 57 inches, grayish-brown (2.5Y 5/2) silt loam; kneads to brown (10YR 4/3) or olive (5Y 5/3); friable; massive; many, fine, distinct, yellowish-brown (10YR 5/6) and strong-brown (7.5YR 5/6) mottles; many concretions of black oxide; slightly acid.

The A1 horizon ranges from 3 to 6 inches in thickness and from very dark gray (10YR 3/1) to dark gray (10YR 4/1) in color. The Ap horizon is dark gray (10YR 4/1)

A3—16 to 20 inches, black (10YR 2/1) to very dark gray (10YR 3/1) light silty clay loam; kneads to very dark gray (10YR 3/1); friable to firm; moderate, very fine, subangular blocky structure; medium acid; clear, smooth boundary.

B1—20 to 25 inches, very dark gray (10YR 3/1) heavy silty clay loam; kneads to very dark grayish brown (2.5Y 3/2); firm; moderate, medium, prismatic structure breaks to strong, fine, subangular and angular blocky structure; few, fine, distinct, dark yellowish-brown (10YR 4/4) mottles; thick continuous clay films; slightly acid; clear, smooth boundary.

B2g—25 to 36 inches, mixed dark-gray (5Y 4/1) and dark grayish-brown (2.5Y 4/2) heavy silty clay loam to light silty clay; kneads to grayish brown (2.5Y 5/2); firm; moderate, medium, prismatic structure breaks to strong, medium, subangular and angular blocky structure; few, fine, distinct, dark yellowish-brown (10YR 4/4) and yellowish-brown (10YR 5/6) mottles; thick continuous clay films; few fine concretions of black oxide; common, black, fine tubular pores in peds; slightly acid; clear, smooth boundary.

B3g—36 to 47 inches, gray (5Y 5/1) medium silty clay loam; crushes to olive gray (5Y 5/2); friable to firm; weak, coarse, prismatic structure breaks to weak, coarse, zon. The B and C horizons of the Tama soils developed from loess, whereas the B horizons of the Dinsdale soils developed from loess and glacial till. The Kenyon soils formed from loamy glacial till.

The Tama soils are the well drained members of the toposequence that includes the somewhat poorly drained Muscatine soils. They are the prairie members of the biosequence that includes the prairie-forest transition Downs and the forest-formed Fayette soils.

Profile of Tama silty clay loam, 600 feet west and 30 feet south of the NE. corner of sec. 1, T. 80 N., R. 12 W., on a 3 percent convex slope, in a cornfield.

Ap—0 to 9 inches, black (10YR 2/1) to very dark brown (10YR 2/2) light silty clay loam; kneads to very dark brown (10YR 2/2); friable; clods break to weak, medium, granular structure; medium acid; clear, smooth boundary.

A3—9 to 15 inches, very dark grayish-brown (10YR 3/2) light silty clay loam; friable; moderate, fine, subangular blocky structure; medium acid; clear, smooth boundary.

B1—15 to 23 inches, dark-brown (10YR 3/3) light silty clay loam; kneads to dark brown to brown (10YR 4/3); friable; weak, very fine, subangular blocky structure; few very dark brown (10YR 2/2) worm casts; medium acid; gradual, smooth boundary.

B21—23 to 32 inches, dark-brown to brown (10YR 4/3) medium silty clay loam; kneads to dark yellowish brown (10YR 4/4); friable to firm; moderate, medium, subangular blocky structure; thin discontinuous clay films; medium acid; gradual, smooth boundary.

B22—32 to 43 inches, dark-brown to brown (10YR 4/3) light silty clay loam; kneads to yellowish brown (10YR

range of 2 to 14 percent. They are about 20 feet higher in elevation than adjoining soils on benches along the Iowa River and from 20 to 30 feet lower than soils on uplands to the south. The native vegetation was trees.

The Tell soils are moderately rapidly permeable and generally are acid throughout. They have a very dark gray, friable silt loam A1 horizon; a grayish-brown, friable, platy silt loam A2 horizon; and a brown to yellowish-brown light silty clay loam B horizon. Yellowish-brown or brownish-yellow sand occurs at a depth between 24 and 40 inches.

These soils are similar to the Fayette soils in color and texture but are underlain by fine sand at a depth of 24 to 40 inches. They differ from the Lamont soils in having a lower content of sand in the A horizon and upper part of the B horizon and in having more strongly developed structural peds in the B horizon. They differ from the Waukegan soils in that they have an A2 horizon, are lower in content of sand in the A horizon and upper part of the B horizon, and generally are more acid in the solum.

Profile of Tell silt loam, 735 feet west of Amana dump, in the NE¼ sec. 3, T. 80 N., R. 9 W., on a 3 percent convex slope, in a forest of oak and hickory.

AO—1 inch to 0, black (10YR 2/1) well-decomposed organic leaf mold and litter; abundant fine tree roots; neutral; abrupt, smooth boundary.

A1—0 to 6 inches, very dark gray (10YR 3/1) silt loam, with fine sand grains; friable; moderate, medium, granular structure; tree roots abundant; slightly acid; clear, smooth boundary.

A2—6 to 10 inches, dark-gray (10YR 4/1) to dark grayish-

weak, coarse, prismatic structure breaks to weak, fine and medium, subangular blocky structure; neutral.

The A1 horizon is light or medium silty clay and is black (10YR 2/1 to N 2/0) or very dark gray (10YR 3/1 to N 3/0). The A horizon is more than 20 inches thick. Colors with values of 3 or less extend to a depth of 40 inches in many places. The B horizon is distinctly gleyed, but other than this there is little or no evidence of genetic development. Clay films are lacking but shiny ped exteriors are common. The B horizon is medium or heavy silty clay and clay. The reaction is slightly acid or neutral.

WALFORD SERIES. The Walford series consists of poorly drained Planosols (Mollic Albaqualfs) that developed from loess, low in content of sand. These soils occupy

B22—21 to 37 inches, grayish-brown (2.5Y 5/2) heavy silty clay loam; kneads to dark brown (10YR 4/3); firm; weak, medium, prismatic structure breaks to moderate, medium, subangular blocky structure; common, fine, distinct, yellowish-brown (10YR 5/6) mottles; thin continuous clay films; few black-coated root channels; few fine concretions of black oxide; many fine tubular pores; medium acid; gradual, smooth boundary.

B3—37 to 47 inches, mixed light brownish-gray (2.5Y 6/2) and yellowish-brown (10YR 5/6) light to medium silty clay loam; kneads to grayish brown (2.5Y 5/2); friable to firm; weak, coarse, prismatic structure breaks to weak, coarse, subangular blocky structure; few, fine, distinct, strong-brown (7.5YR 5/6) mottles; few fine concretions of black oxide; many, fine, dark-colored tubular pores; common, fine, black-coated root channels; neutral; gradual, smooth boundary.

C—47 to 60 inches, mixed light brownish-gray (2.5Y 6/2) and yellowish-brown (10YR 5/6) heavy silt loam; kneads bers of the toposequence that includes the somewhat poorly drained Koszta soils.

Profile of Watkins silt loam, 309 feet west and 200 feet

mantled Iowan till plain. The slope ranges from 2 to 9 percent. The A horizon and the upper part of the B horizon developed from loess, and the lower part of the B black oxide stains; medium acid; gradual, smooth boundary.

IIC—57 to 67 inches, yellowish-brown (10YR 5/4) loam; friable to firm; massive with vertical cleavage; few, fine, faint, strong-brown (7.5YR 5/6) mottles, and common, thin, grayish-brown (10YR 5/2) streaks; few black oxide stains; neutral; clear, wavy boundary.

IIC2—67 to 75 inches, yellowish-brown (10YR 5/4) loam; friable; massive; few, fine, distinct, strong-brown (7.5YR 5/6) mottles; few, thin, grayish-brown (10YR 5/2) streaks; few fine concretions of lime; moderately alkaline.

The A1 horizon is very dark gray (10YR 3/1) to very dark grayish brown (10YR 3/2) and is from 4 to 6 inches thick. The A2 horizon is weakly defined and is from 2 to 4 inches thick. In cultivated areas, it commonly is part of the Ap horizon. If the A2 horizon is lacking, the boundary from the Ap horizon to the B horizon is abrupt and very distinct. The B horizon has color values of 4 and 5 and chromas of 3 and 4. Some coats with a chroma of 2 commonly occur in the upper part of the B horizon. Silt coats and clay films are distinctly evident in the B horizon. In places there are a few, fine, gray to

IIC1—33 to 41 inches, yellowish-brown (10YR 5/4) fine and medium sand; loose; incoherent; single grain; medium acid; gradual, smooth boundary.

IIC2—41 to 60 inches, light yellowish-brown (10YR 6/4) sand; loose; incoherent; single grain; medium acid; band of loose, dark yellowish-brown (10YR 4/4) loamy sand and iron, 1½ inches thick, at depth of 52 inches.

Profile of Waukegan loam, 950 feet west and 210 feet north of the center of sec. 4, T. 80 N., R. 9 W., on a 7 percent convex slope in a cultivated field, 90 feet south of U.S. Highway No. 6.

Ap—0 to 8 inches, very dark brown (10YR 2/2) and some dark-brown (10YR 4/3) loam to gritty silt loam; kneads to very dark grayish brown (10YR 3/2); friable; many noticeable fine sand grains; weak, fine, granular structure; neutral; clear, smooth boundary.

AB—8 to 15 inches, dark-brown (10YR 3/3) and some brown (10YR 4/3) silt loam; kneads to dark brown (10YR 3/3); friable; noticeable sand content; weak, fine, subangular blocky structure; medium acid; gradual, smooth boundary.

B2—15 to 26 inches, dark-brown to brown (10YR 4/3) light silty clay loam; friable; noticeable sand content; weak, medium, subangular blocky structure; medium acid; clear, smooth boundary.

The A1 horizon is very dark gray (10YR 3/1) to very dark brown (10YR 2/2) and is from 8 to 16 inches thick. The A horizon is loam to silt loam. The B horizon has color values of 3 and higher and chromas of 3 and higher. There are no mottles in the B horizon, and the texture is light silty clay loam but ranges to medium silty clay loam in places. Leached coarse-textured material occurs between a depth of 20 and 40 inches in Waukegan loam and between a depth of 24 and 45 inches in Waukegan silt loam. The solum typically is medium acid but may be less acid at or near the surface.

WIOTA SERIES. The Wiota series consists of well

The A1 horizon is black (10YR 2/1) to very dark brown (10YR 2/2) and is from 14 to 18 inches thick. The A horizons commonly have color values of 3 or lower to a depth of 24 inches. The B horizon ranges from heavy silt loam to medium silty clay loam. In places some yellowish-brown, strong-brown, or grayish-brown mottles are evident in the B3 and C horizons. The C horizon is silty clay loam to loam. Coarse-textured strata may occur below a depth of 48 inches. The solum typically is medium acid but ranges to slightly acid in some places.

ZOOK SERIES. The Zook series consists of poorly drained soils that formed from slack-water sediments. These soils

General Nature of the Area

This section was prepared mainly for those not familiar with the county. It discusses the vegetation, topography, drainage, and climate of the county.

Vegetation

The native vegetation of Iowa County consists mainly of prairie grasses and of oak-hickory type forest. At one time prairie grasses covered much of the nearly level to rolling uplands, especially in the central part of the county between Conroy and Parnell. Oak-hickory type forest generally occupied the steeper areas near and along streams. In some areas the trees formed large wooded tracts across the upland divides. From the nature and distribution of soil types, it appears that the forest invaded the grasslands along the major stream valleys and then gradually spread out from the valleys to the uplands.

Few areas now remain in native vegetation or in vegetation that has not been changed in some way. Bluestem, a tall native prairie grass, has been practically eliminated by grazing and cultivation. Some scattered patches occur along the right-of-way of railroads or on banks of unimproved county roads. In places the bluestem has been replaced by bluegrass.

Most of the native timber has been cut over. The largest areas of timber are north and south of the Iowa River in the Amana Colonies. Selective cutting has been practiced throughout these areas.

Topography

Iowa County is a gently rolling to steep upland plain, deeply dissected in places by rivers and streams. The area immediately north of the Iowa River is characterized by an intricate pattern of deep valleys and ravines that have steep slopes. Small streams extend back into the uplands.

The bottom lands along the Iowa River are nearly level; the terraces away from the river are nearly level to undulating.

Hills on either side of the flood plain rise from 100 to 200 feet above the river. In places these hills are from 50 to 100 feet above the level of the plain into which they merge.

The northern corner of Lenox Township, for the most part, has level or gently undulating topography that is characteristic of what has been called the Iowan drift plain.

In a broad curve from east to west across the central part of the county is a more nearly level plain, 4 or 5 miles wide, called the divide. This plain, which represents the greatest part of the original prairie land of the county, separates the Iowa and English Rivers. The English River, its tributaries, and many small intermittent streams have cut steep valleys along this entire area. The slope in this area increases in steepness toward the stream channels.

Drainage

Streams and intermittent drainageways have dissected practically all parts of the county. The Iowa River extends from west to east through the northern part. Honey Creek, Big Bear Creek, and Little Bear Creek are the main tributaries flowing into the Iowa River from the south. Price Creek, which flows almost at right angles into the Iowa River, is the main tributary from the north. From Conroy eastward, the area is drained by Clear Creek. Hog Run joins Old Mans Creek west of Williamsburg to drain the area east of Williamsburg and Parnell. The southern

TABLE 8.—*Summary of temperature and precipitation*

[Based on a 30-year record,

Month	Temperature in °F.					Mean heating degree-days [1]
	Mean			Extreme		
	Daily	Daily	Monthly	Record highest	Record lowest	

part of the county is drained by the English River and its tributaries.

The drainage system is well developed and is adequate in most parts of the county. However, artificial drainage is needed in some depressed areas on uplands and on bottom lands that are above ordinary overflow but that receive runoff from surrounding steep uplands.

Climate[10]

The climate in Iowa County is typically continental, with frequent and often rapid changes in weather throughout the year. The summers are warm and the winters cold, but prolonged periods of extreme heat or intense cold are

The largest amount of rainfall recorded in a day at Williamsburg was on June 15, 1930, when 6.02 inches fell. However, a 3-inch rainfall in 24 hours and 1.45-inch in 1 hour can be expected about once every other year.

Normally, about two-thirds of the annual precipitation falls during the growing season, or from April through September. The seasonal peak occurs in June. The chance of an inch or more of rainfall per week (about the requirement of growing corn) is about 4 in 10 during June, and about 3 in 10 during July and August. The driest period in summer is the last two or three weeks of August. Beginning August 16, the probability of two consecutive rainless weeks is about once in 13 years, and the proba-

TABLE 9.—*Probabilities of last freezing temperature in spring and first freezing temperature in fall*

Probability	Dates for given probability and temperature				
	16° F. or lower	20° F. or lower	24° F. or lower	28° F. or lower	32° F. or lower
Spring:					
1 year in 10 later than	Mar. 31	Apr. 10	Apr. 19	May 1	May 13
2 years in 10 later than	Mar. 26	Apr. 4	Apr. 13	Apr. 26	May 8
5 years in 10 later than	Mar. 17	Mar. 24	Apr. 2	Apr. 17	Apr. 28

able in most parts of the county; and motor freight lines serve every trading center in the county.

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B horizon.—The horizon in which clay minerals or other material has accumulated, that has developed a characteristic blocky or prismatic structure, or that shows the effects of both processes.

C horizon.—The unconsolidated material immediately under the true soil. In chemical, physical, and mineral composition it is presumed to be similar to the material from which at least part of the overlying solum has developed.

Leaching, soil. The removal of materials in solution by the passage of water through soil.

Parent material. The weathered rock or partly weathered soil material from which soil has formed; horizon C in the soil

the lower limit of very fine sand (0.05 millimeter). As a textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Solum, soil. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soil includes the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoin-

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